A webcomic of romance, sarcasm, math, and language

xkcd

RANDALL MUNROE

2016

xkcd

2016

a collection of 156 webcomics

from #1624 to #1779

by Randall Munroe

January 01, 2016

Want to feel old? Wait.

Explanation

This New Year comic, the second in a row, is using a common genre of Internet humor, which Randall has used several times before, in an attempt at making people feel old. This is done by mentioning the ages of various things (often movies) which came into existence during their lifetime. Since many people tend to think of anything that they can remember a time before as "new", this often provokes a feeling of age and out-of-touchness.

In this comic, Cueball has crashed through the roof into the bedroom of a sleeping White Hat (note the white hat on the bed) on New Year's morning. This wakes White Hat up, and Cueball then asks him if he "want[s] to feel old". Without waiting for a reply he starts to make such a list of things that will turn 10 and 20 years old in 2016, before he is interrupted (as he was about to continue mentioning even older things).

White Hat is clearly less interested in Cueball's attempts to make him feel old than he is in the fact that Cueball has apparently crashed through his ceiling and woken him early in the morning on New Year's Day. To which Cueball just replies that 2016 is already hours old and that time is passing. As it is New Year's morning, White Hat has probably not been in bed too long and may even be drunk/hung-over, so he is acutely aware that the New Year is only a few hours old, and also that time is passing.

Night at the Museum and Cars are both children's films

from December and June of 2006 respectively, Hips Don't Lie was an inescapable hit for Shakira released in February 2006, and the Wii is a Nintendo game console which was released in November 2006. If you were born in the early-to-mid nineties, these were probably cultural touchstones of your childhood - most people who enjoyed these are now adults.

The films Twister and Independence Day are both disaster movies that were huge box office hits from May and July 1996. Twister is also the name of a game introduced approximately 30 years earlier, so White Hat would feel young, but confused, if he misunderstood and thought he was being told that a game he remembers seeing as a small child is now only 20 years old. The Rock probably refers to the action film The Rock from June 1996, but it could also refer to the wrestler The Rock, who made his WWF/E debut in 1996 (he remains a celebrity to this day, although you may know him by his real name, Dwayne Johnson). The first games in the Pokémon series came out in Japan in February 1996 (though they would not come out in North America until 1998 and Europe until 1999). Wonderwall was perhaps the biggest hit for the band Oasis and remains a favorite of acoustic guitarists to this day. It was actually released in 1995 (mistake by Randall?) But it was probably first big in the US in 1996, and also an acoustic MTV Unplugged version was recorded in 1996.

Cueball entering a room hanging by a wire could also be a reference to an iconic scene in the film Mission: Impossible, also released in 1996.

This strip is a joke about how common such memes are; Cueball is so eager to note what cultural items have reached major benchmarks of age that he feels the need to break into White Hat's house and announce it mere hours after 2016 begins.

The title text adds a humorous alternative to suggested ways to feel old - by waiting, although one would have to wait for some time to experience noticeable results. It is only a couple of weeks ago that Beret Guy used this technique to travel forward in time in 1617: Time Capsule.

There have been two previous New Year's comics with only the year used as the title: 998: 2012 in 2012 and 1311: 2014 in 2014. For some reason, this trend only seems to happen with the even-numbered years, but that ended in 2017 with 1779: 2017, making this the first of at least two years in a row with New Years comics using the new year as the title.

A similar situation is seen in 225: Open Source where two ninjas smashes through a skylight window hanging down from a rope, waking a person in a bed. In that case they are actually threatening the sleeping guy.

This comic also reveals for the first time that White Hat has hair.

#1625: Substitutions 2

January 04, 2016

MORE
SUBSTITUTIONS
THAT MAKE READING THE NEWS MORE FUN

DEBATE →	DANCE-OFF
SELF DRIVING →	UNCONTROLLABLY SWERVING
POLL →	PSYCHIC READING
CANDIDATE →	AIRBENDER
DRONE →	DOG
VOWS TO →	PROBABLY WON'T
AT LARGE →	VERY LARGE
SUCCESSFULLY →	SUDDENLY
EXPANDS →	PHYSICALLY EXPANDS
FIRST/SECOND/THIRD-DEGREE →	FRIGGIN' AWFUL
AN UNKNOWN NUMBER →	LIKE HUNDREDS
FRONT RUNNER →	BLADE RUNNER
GLOBAL →	SPHERICAL
YEARS →	MINUTES
MINUTES →	YEARS
NO INDICATION →	LOTS OF SIGNS
URGED RESTRAINT BY →	DRUNKENLY EGGED ON
HORSEPOWER →	TONS OF HORSEMEAT

Within a few minutes, our roads will be full of uncontrollably-swerving cars and our skies full of Amazon delivery dogs.

Explanation

This is the second comic in the Substitution series where Randall has suggested substitutions that will make reading the news more fun. But there have been several comics using substitutions both before and after these ones.

The series as of 2016:

- 1288: Substitutions
- 1625: Substitutions 2
- 1679: Substitutions 3

In this table, Randall suggests substituting several common phrases in generic news with similar or related phrases that mean something different for comical effect. Some of the replacements are synonyms, some are antonyms and some are plain different concepts; and, even though they would (most of the time) make a grammatically correct sentence, the resulting idea would, however, often sound absurd or bizarre.

Some of the examples might, also, mock the fact that many news contradict the actual facts or obvious results of a situation. For example, "[influential person] vows to do good to the world" would be replaced with a more usual fact "[influential person] probably won't do good to the world" - see example below with North Korean leader.

The title text is an example of how the closing sentence of a given article or report might sound after using the substitutions in the comic.

The flying dogs could be a reference to 1614: Kites. Was the first of two in a row where Amazon is mentioned in the title text (next 1626: Judgment Day).

Table of substitutions[edit]

- In this table the difference between the original and the substituted word (and the change to the sentences) will be explained.

Example of sentences are given below.

Example of sentences[edit]

- Here follows some real examples with links to the news/text:

Words from the list, and the replacement words, are highlighted with bold font.

All words are included at least once, and the list is sort of sorted after the order the words appear in the comic, but most sentences have more than one word from the list, on purpose!

- Original sentence: Fifth Republican debate: where each candidate excelled and faltered
- Original sentence: 1,000-Horsepower Self-Driving Electric Faraday Future Concept Leaked?
- Original sentence: A new Morning Consult poll shows real estate mogul Donald Trump remains on top as the GOP frontrunner following Tuesday's debate.

- Original sentence: North Korea's Kim vows to raise living standards

- Original sentence: Murderers and rapists among 1,153 criminals still at large after being recalled to prison over the last 30 years

- Original sentence: Pakistan successfully tests first indigenous armed drone

- Original sentence: Obama Expands Gun Controls in Executive Moves

- Original sentence: There was no indication of first degree familial relationships in the analyzed dataset.

- Original sentence: ...rescue crews continued to collect bodies and interview survivors, including an unknown number of wounded languishing in homes and hospitals with third degree burns

- Original sentence: The Republican presidential front-runner faces a global firestorm

- Original sentence: U.S. presidential candidate Barack Obama on Friday urged restraint by both Russia and Georgia in the conflict over the breakaway region of South Ossetia in Georgia.

- Original sentence: Video: 52-Horsepower Citroen AX Laps Nurburgring In Under 10 Minutes

#1626: Judgment Day

January 06, 2016

THE MOMENT THE COMPUTERS
CONTROLLING OUR NUCLEAR
ARSENALS BECAME SENTIENT

It took a lot of booster rockets, but luckily Amazon had recently built thousands of them to bring Amazon Prime same-day delivery to the Moon colony.

Explanation

Judgment Day, from the Terminator film franchise, refers to the day that the artificial intelligence (AI) Skynet becomes self-aware and starts a nuclear strike on the United States, Russia, and other regions, killing three billion people. The term "Judgment Day" itself (also spelled "Judgement Day") is a Biblical reference to the day that God casts his "final judgment" and wipes out the world as we know it, and is typically used to describe any kind of Armageddon (itself, primarily a biblical reference) or any human extinction event. This film is only one example of stories (including books, films and television shows) featuring an AI that decides (or at least threatens) to nuke humanity; this strip could thus be an alternate ending for many stories (including the 1970 film Colossus: The Forbin Project).

In this strip, the AI believes that nuclear weapons are not good things to have, and that the amount of them we have is extreme overkill (14,700 held by the U.S.A and Russia now, 71,000 in the past). Once it's done freaking out, its solution is to shoot the world's nuclear arsenal into the sun. But before it does so it asks the humans: What's wrong with you? It has thus passed a judgment over humanity. The comic title is thus a pun on the word "judgment" since the computer is being judgmental with humanity and scolding us while correcting our ways, instead of instigating Judgment Day or any other kind of Armageddon.

As pointed out in the what if? article Robot Apocalypse, nuclear weapons aren't any safer for computers than for human beings (the EMP would destroy circuits), so an AI would want them gone as quickly as possible.

North Korea claimed to have successfully tested its first hydrogen bomb on the evening of the day before this comic was published; at about 8:30 PM in Massachusetts where Randall lives. At that time it was already 10:00 AM on the day of the comic's release in Pyongyang, the capital of North Korea, but that was still several hours before this comic was released. This comic could thus be Randall's response to the ongoing nuclear arms race.

Even the most powerful of nuclear weapon launchers, intercontinental ballistic missiles, are not designed to make anything other than sub-orbital flights and could not fly to the Sun (which is actually surprisingly difficult, even with the soon-to-be-mentioned extra boosters, since the rocket would not have enough delta-v to bleed off the orbital speed of the Earth around the Sun - it is likely that the sentient AI is using the same strategy of the Solar Probe Plus and planning several flybys of Venus to do that work). The title text rationalizes that the capability to do so may perhaps be granted by the use of an Amazon resource that might have also been developed by the time of this instance of computer sentience, aided (if not initiated!) by the fact that Amazon's whole business infrastructure is already highly computerized and could at the very least be complicit with the process of delivering and then controlling the rocket-power, without any conscious human intervention. As there is

not yet an extended colony on the Moon, it will for sure take many years before we reach this future scenario.

"A lot of booster rockets" is likely to be a reference to the spaceflight simulator game Kerbal Space Program, which Randall has referenced several times. In the culture of that game, any launch failure can be resolved by "adding more boosters" to the spaceship design.

Adding a second layer to the humor, the machine's reaction could also be read as the reaction of someone who has moved in with someone else, discovered a collection they find distasteful, and is now changing things to fit their preferences. "Oh my God, why do you even have all of these [tschotskes, ratty tee shirts, porn magazines, handcuffs, dildos, slime-mold samples]." Upon obtaining sentience, the machine is the new roommate of the human race and is expressing its disgust at one of our dirtier habits.

Related comics[edit]

This is the second time in a few months that the speed of Amazon's deliveries has been the subject of a joke, the last time was 1599: Water Delivery, where it was the one hour delivery that was the subject of the joke. It is also the second title text in a row (after 1625: Substitutions 2) where Amazon's robotized delivery services have been mentioned.

This particular 'machine take-over' future is in distinct contrast to the possible future directions given in 1613: The Three Laws of Robotics, but this comic likely depicts spontaneous self-sentience, not a system with deliberately imposed human 'values' and

possibly no actual conscience or even consciousness of its own. Other problems with hostile AI take over is presented when it fails completely in 1046: Skynet. Also it is not all AI that wish to interact with us at all as shown in 1450: AI-Box Experiment. These are just a few of the many comics about AI in xkcd .

Within a year Randall has made several other comics about nuclear weapons, one of these, 1655: Doomsday Clock, came just 10 weeks after this one and before that these two were released in 2015, 1539: Planning and 1520: Degree-Off. Nuclear weapons are also mentioned twice in Thing Explainer, specifically they are explained in the explanation for Machine for burning cities about thermonuclear bombs, but they are also mentioned in Boat that goes under the sea about a submarine that caries nukes. All three comics and both explanations in the book, does like this comic, comment on how crazy it is that we have created enough firepower to obliterate Earth several times (or at least scourge it for any human life).

#1627: Woosh

January 08, 2016

NOTHING CREATES MORE CONFUSION THAN MY BOT THAT REPLIES TO RANDOM INTERNET COMMENTS WITH "WOOSH".

It also occasionally replies with 'Comment of the year', 'Are you for real', and 'I'm taking a screenshot so I can remember this moment forever'.

Explanation

Replying to a comment with "woosh" generally indicates that there was a joke, and the commenter failed to recognize it (or they prefer not to recognize it, if the joke is rather obscene) — "woosh" is an onomatopoeia for the joke metaphorically "flying over their head". A bot replying to comments with "woosh" at random would be very confusing, as people would search for the nonexistent joke they missed. This is similar to 559: No Pun Intended.

"Comment of the year," just like the original bot reply, could be taken two ways but both would likely cause confusion. Either the reader takes the "CotY" at face value, implying that the original comment is extremely significant, or as a sarcastic quip, which would give it basically the same meaning as "woosh", suggesting that the commenter had an unoriginal or ridiculous idea.
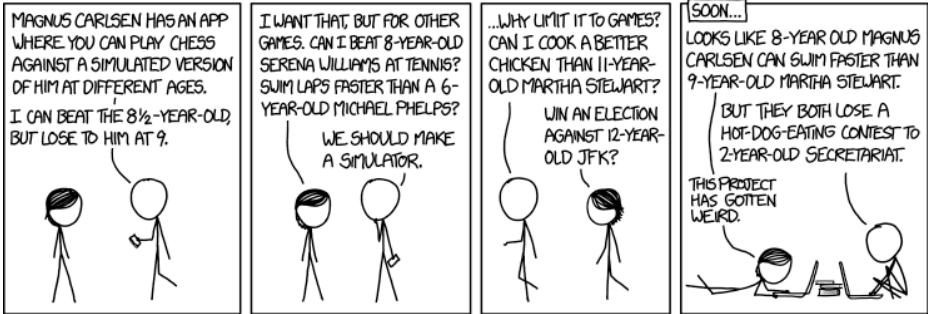
"Are you for real" implies that the commenter (the bot) doesn't believe that the original commenter is serious.

"I'm taking a screenshot so I can remember this moment forever" either adds an implied air of extreme importance, hilarity or significance to a comment, or sarcastically suggests that the comment was unoriginal, useless, or otherwise unimportant. People who read it might assume that there is a hidden joke or meaning somewhere inside the original comment.

So the point of creating such a bot is for spreading massive confusion, where there wouldn't be any in the absence of the bot's comments.

#1628: Magnus

January 11, 2016

Panel 1: MAGNUS CARLSEN HAS AN APP WHERE YOU CAN PLAY CHESS AGAINST A SIMULATED VERSION OF HIM AT DIFFERENT AGES.
I CAN BEAT THE 8½-YEAR-OLD, BUT LOSE TO HIM AT 9.

Panel 2: I WANT THAT, BUT FOR OTHER GAMES. CAN I BEAT 8-YEAR-OLD SERENA WILLIAMS AT TENNIS? SWIM LAPS FASTER THAN A 6-YEAR-OLD MICHAEL PHELPS?
WE SHOULD MAKE A SIMULATOR.

Panel 3: ...WHY LIMIT IT TO GAMES? CAN I COOK A BETTER CHICKEN THAN 11-YEAR-OLD MARTHA STEWART?
WIN AN ELECTION AGAINST 12-YEAR-OLD JFK?

Panel 4: SOON...
LOOKS LIKE 8-YEAR OLD MAGNUS CARLSEN CAN SWIM FASTER THAN 9-YEAR-OLD MARTHA STEWART.
BUT THEY BOTH LOSE A HOT-DOG-EATING CONTEST TO 2-YEAR-OLD SECRETARIAT.
THIS PROJECT HAS GOTTEN WEIRD.

In the latest round, 9-year-old Muhammad Ali beat 10-year-old JFK at air hockey, while Secretariat lost the hot-dog-eating crown to 12-year-old Ken Jennings. Meanwhile, in a huge upset, 11-year-old Martha Stewart knocked out the adult Ronda Rousey.

Explanation

Cueball shows Megan an app, Play Magnus (iOS, Android) which claims to simulate playing chess against Magnus Carlsen at various ages. Carlsen is a chess grandmaster who is the world champion as of the date this comic was released. The idea behind the app is that as Carlsen grows up he becomes better at chess and thus it become exceedingly difficult to beat him as he gets older. As Cueball claims he could have beaten Magnus when he was 8½-year-old, but not a half-year later, we can now estimate Cueballs strength to be that of a typical adult hobbyist, with a FIDE rating of about 1200.

Taking the idea a step further, Megan wants such an app for other sports tennis and swimming, where skill couldn't imaginably be simulated via an app at all. She wants to compare herself to an 8-year-old Serena Williams, a top-ranked professional tennis player. Or to a 6-year-old Michael Phelps, the most decorated Olympian competitor of all time.

Cueball expands beyond sport, wishing to determine if he could cook better than an 11-year-old Martha Stewart (author of several cookbooks). Megan wonders if she'd have won an election against a 12-year-old JFK (John F. Kennedy, the 35th American President). Obviously, cooking and politics were skills acquired later in life for both figures. Also, the U.S. Constitution prohibits anyone from serving as President before the age of 35, so it seems unlikely that any 12-year-old candidate could

win, regardless of skill level, simply because voters would not want to elect someone ineligible to serve for another 23 years. Such a contest would likely be prohibited altogether, as ineligible candidates tend to have ballot access issues.

Cueball and Megan continue speculating about an app simulating the skills of random celebrities at various ages, even beyond the talents that made them famous. They finally end up comparing 8-year-old Magnus's swimming skill against 9-year-old Martha's (he wins). But they'd both lose a hot dog-eating contest against the championship racehorse Secretariat at the age of two, which is not surprising since a horse is an adult at two years old, and is much larger and eats much more than a human. At this point even Megan realizes (with considerable understatement) their project "has gotten weird". Chess was previously compared to basketball in 1392: Dominant Players, which also mentioned Magnus. This is the tenth comic about chess on xkcd .

The title text extends the point to even greater absurdity, e.g. the ludicrous prospect of a young Martha Stewart knocking an adult Ronda Rousey (professional wrestler, former UFC champion, and actress) unconscious, or 9-year-old Muhammad Ali (professional boxer and activist) beating a 10-year-old JFK in air hockey. The former may be a reference to the fact that professional wrestling is more entertainment than competition, and the outcomes are often pre-staged, so the victor would not depend on which contestant was more skilled. This was also referenced in the title text of 2291: New Sports

System. The horse also gets re-mentioned in the title text, losing in a hot dog eating contest against 12-year-old Ken Jennings (at time of comic writing record-holder of winning streak on television game show Jeopardy!).

#1629: Tools

January 13, 2016
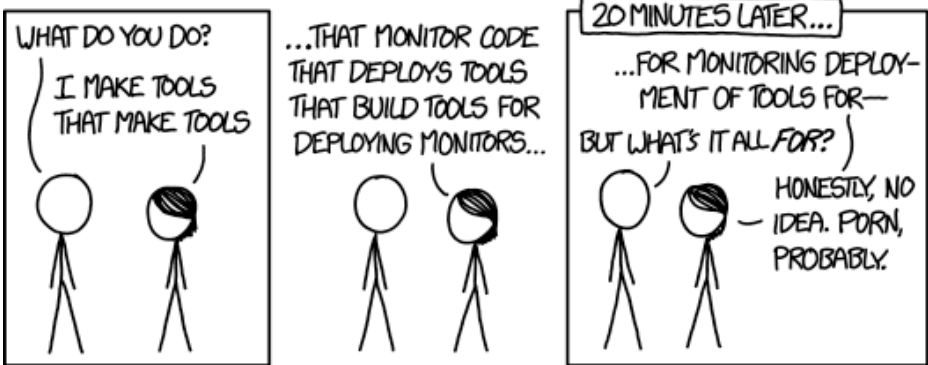
I make tools for managing job-hunting sites for people who make tools for managing job-hunting sites for people who make tools for ...

Explanation

Cueball asks Megan what she does, and she begins by answering "I make tools that make tools." So far, this is a common expression of the way a sophisticated technology is built on simple building blocks, with one set of tools used to build a more powerful set of tools, and so on.

However, the iterations are carried to comical lengths, with Megan spending twenty minutes reeling off various steps including development of software code, and software code debugging/development tools. And she is not even finished when Cueball breaks into her endless list after she once again says tools for by asking what is it for? (See also: 1579: Tech Loops).

Megan readily admits that she doesn't even know the goal of these tasks, and guesses that it is probably for porn, referencing the not-entirely-unfounded stereotype that the majority of internet traffic is pornographic websites. Knowing that many information technologies, from printing to computers, are quickly adopted by porn producers and distributors, this is not a bad guess on Megan's part. Further, many internet related advances have had their way paved by a porn industry that needed secure and secret payments options, and better bandwidth for downloading films, as well as making it more accessible, etc.
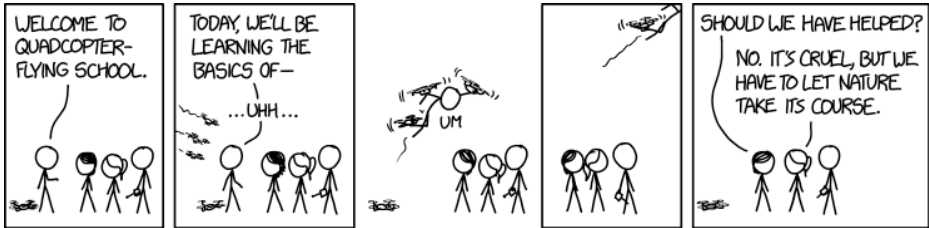
In the title text there is a recursion as someone (maybe

Cueball) tells what they do. And in this case they make tools for managing job-hunting sites for people who make tools for managing job-hunting sites for people who make tools for ... (ad infinitum). See also other comics about Recursion.

Regarding porn in xkcd see also 305: Rule 34.

#1630: Quadcopter

January 15, 2016

Panel 1: WELCOME TO QUADCOPTER-FLYING SCHOOL.

Panel 2: TODAY, WE'LL BE LEARNING THE BASICS OF— ...UHH...

Panel 3: UM

Panel 5: SHOULD WE HAVE HELPED? NO. IT'S CRUEL, BUT WE HAVE TO LET NATURE TAKE ITS COURSE.

I always have to turn off nature documentaries when they show these scenes.

Explanation

There is large controversy over unmanned small-scale quadcopters, which are a type of radio-controlled helicopter. Some people have objections towards the usage of quadcopters as, if equipped with cameras, they can potentially interfere with personal privacy and may pose a physical aerial hazard.

For this reason the US Federal Aviation Administration is now requiring any "drone" (unmanned aerial vehicle) to be registered so that it can find out whose fault it might be that a quadcopter interfered with commercial aircraft — or carried off a citizen to be devoured.

This comic takes place during a lesson where Cueball is a teacher. He is standing in front of his students (Megan, Ponytail and another Cueball-like guy), presenting to the class. He has a quadcopter lying ready on the ground behind him, and has apparently handed the remote control to the other cueball, presumably so he can try it once the introduction is over.

But then the teacher is attacked by three rogue quadcopters flying in from behind him. They grab him, lift him off the ground (a very complicated maneuver), and fly away with him. Meanwhile, his students just stand there watching and do nothing to help him. Afterwards Megan asks if they should actually have tried to help him, but then Ponytail takes the view that now that the drones are sentient, they have become a part of

nature, and that you should not interfere but just "let nature take its course". This is a common comment in nature programs about wildlife, where the speaker tries to explain why the team that was there to film the animals dying did nothing to help them - because they will not interfere with nature. This would not be possible in real life assuming they weren't using unknown, advanced technology as Cueball outweighs the drones by several factors.[citation needed]

There is currently a drone called MQ-1 Predator which is used a lot by the CIA and USAF. Although it's not a quad-copter, the idea behind this comic could come from the drone's name-- taking the name literally and giving drones predatory behavior. This comic thus takes people's worries to the extreme, suggesting that the drones become sentient and can cooperate together just like a pack of wolves and grab a human being and fly off with him like an eagle would do with a smaller animal.

The title text refers back to the above as Randall confesses that he has to turn off any nature documentaries which show scenes of animals killing their prey, while the speaker tells that this would be part of nature. This continues the theme of treating drones as an occasionally-ugly but accepted part of nature.

Sentient quadcopters were part of the game in 1608: Hoverboard, where one quadcopter is speaking to the other over the lava lake in the Mount Doom crater to the left. How to solve the problem of too many drones was mentioned in 1523: Microdrones. Just over a week

before this comic was released another comic also had as subject a situation where our technological inventions begins to take control over us, see 1626: Judgment Day. Comparing drones to animals is also present in 1881: Drone Training, when Black Hat Guy asks for a spray bottle for his drone.
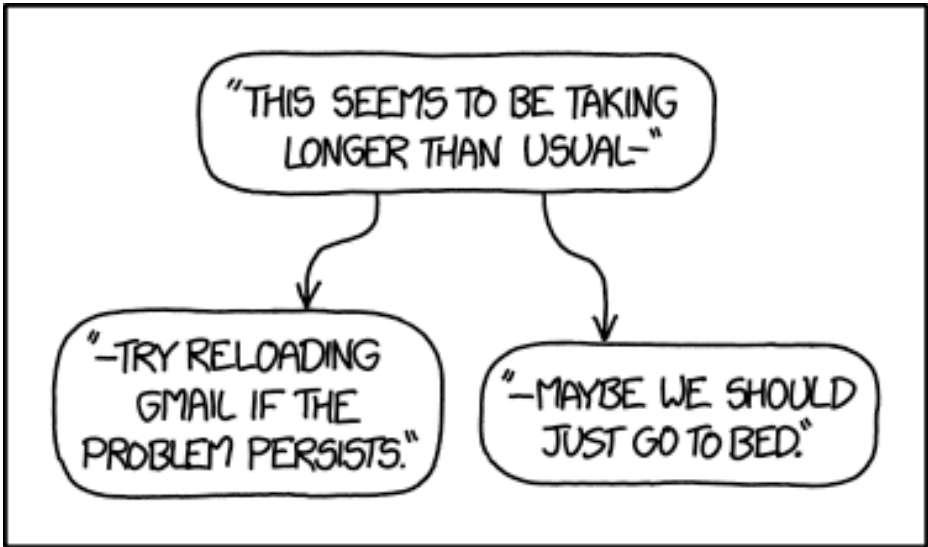
'--> [Well, this is embarrassing.] <--'

Explanation

The comic starts a small flow chart with "This seems to be taking longer than usual." It then presents two alternative continuations of the sentence, which radically alter the interpretation of the starting sentence, resulting in humor.

"This seems to be taking longer than usual" is an error message displayed by Gmail (see here) and other software, for example Disqus, (see here). We realize the allusion to Gmail by the first continuation, "Try reloading Gmail if the problem persists".

In the second continuation, "Maybe we should just go to bed", the opening instead refers to a person suffering from sexual performance anxiety, taking "longer than usual" to achieve either orgasm or erection, probably despite considerable efforts of their partner. Often such frustration then becomes a self-fulfilling prophecy that renders orgasm/erection virtually impossible by ruining the mood. In such situations it is likely that one or the other partner becomes frustrated and gives up, suggesting "let's go to bed" instead of 'pointlessly' continuing the sexual activity.

The title text ties both interpretations together by referencing an infamous error message given by the Firefox internet browser. As an error message, it fits nicely with the Gmail interpretation of the comic, though it is equally likely to be used as an apology or

frustrated slight in the sexual interpretation. It would be a likely next line after "this is taking longer than usual". Alternatively, it would be embarrassing to get the two responses confused, thus necessitating a flowchart as a guide.

It could also simply be a jab to people who stay online late even when doing nothing, as when a lag occurs, and finally realising it might be better to switch off the computer and go to bed; or people who stay up late obsessed that "Someone is wrong on the internet".

This is not the first time Randall juxtaposes sex and more abstract topics, such as sex and math in 487: Numerical Sex Positions or sex and engineering in 592: Drama

A MAN, A PLAN, A GOD'S 'NAM TABLES, NITRATE, TAR, TINSEL, BATMAN'S DOG: ANAL PANAMA.

I hope that somewhere in the world, "Panamax" is the last option on a "size" drop-down menu on a sex toy site.

Explanation

'Nam is an apheresis of Vietnam. See more explanation of the words in the palindrome in the Trivia section. Note that in the original version from the link above there was a comma before tables so it is two items in the list: God's 'Nam, tables, etc. Due to its list like structure, the Panama palindrome is easily extensible by adding additional noun phrases, and some of these extensions lay claim to being "The Longest Palindrome Ever".

The title text references the maximum size of ships that can fit through the Panama Canal, which is Panamax. Randall would really enjoy if this was the last option (i.e. biggest size) on a drop-down menu on a sex toy site. For instance such a site could have a banner saying; "If you have a Panama Anus, then try our Panamax Butt plug".

In the game 1608: Hoverboard there is also a reference to the palindrome and the Panama canal with the song that Cueball sings at the ruin to the right. The first four lines of the song is the same as in the original palindrome but with the "A " changed out with Spider-, and then also Spider in front of Panama:

The Palindrome[edit]

Although it is less logical it is indeed a palindrome:

#1633: Possible Undiscovered Planets

January 22, 2016
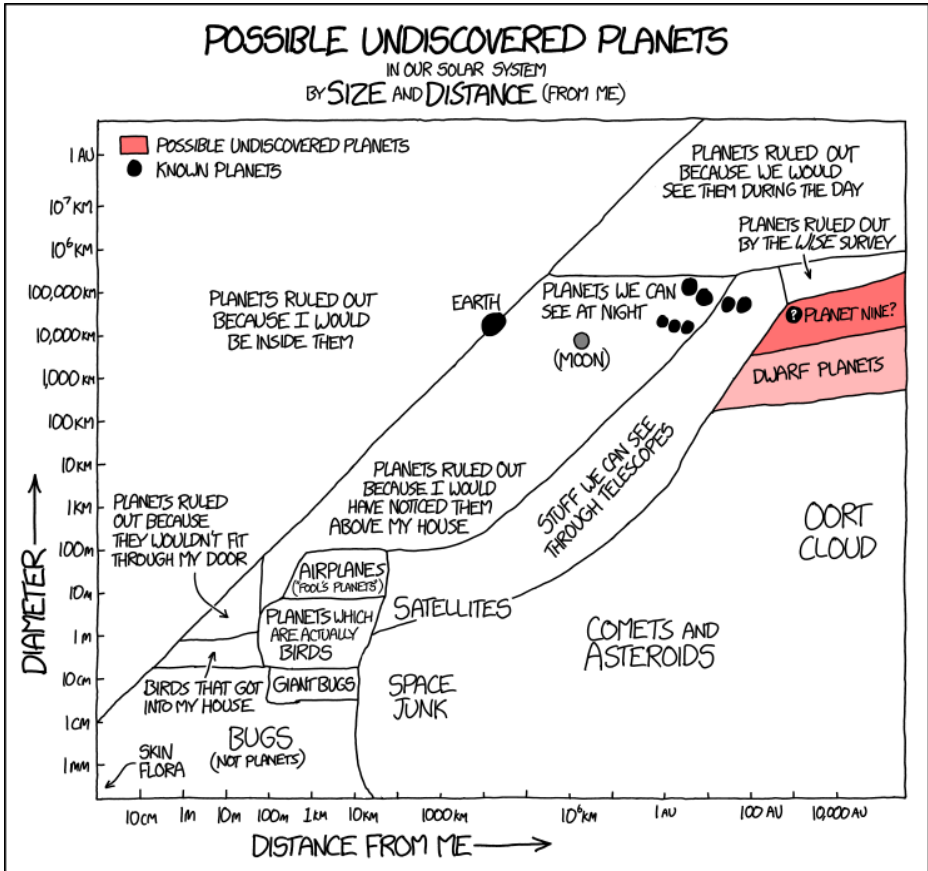
Superman lies near the bird/plane boundary over a range of distances, which explains the confusion.

Explanation

This comic is about Planet Nine, a possible Neptune-sized planet far beyond the farthest planet, Neptune. Astronomers Mike Brown and Konstantin Batygin published a paper on 2016-01-20, only two days before the release of this comic. The paper is called Evidence for a Distant Giant Planet in the Solar System and shows indirect evidence that such a planet may exist, inferred from an otherwise unlikely correlation between the unusual orbits of several dwarf planets. See for instance also explanations, for the layman, of the results here: Astronomers say a Neptune-sized planet lurks beyond Pluto and Planet X Discovered??

As this paper came out on the day of the previous comic's release (1632: Palindrome), this comic's release day was the first release day after the news came out. This explains why this comic was released in the late afternoon rather than just past midnight as is often the case with normal releases.

Once Randall heard this news, he had to decide to do this comic instead of the scheduled comic, and then invent and draw a completely new and actually very complicated comic (resulting in several position errors) about "Planet X" before he could release this comic.

Now this planet could be called Planet IX (and is labeled Planet nine? on the chart), as Pluto, the previously "planet 9" has been degraded to a dwarf planet. The "X" did, however, not only refer to the roman numeral! Note

that Mike Brown is the astronomer that killed Pluto, or at least reduced Pluto to a dwarf planet, something that has been a subject in xkcd before; see for instance 473: Still Raw.

This was the first of two times within a month where a new astronomical announcement (of something discovered months before the actual announcement) resulted in a related comic. The second being 1642: Gravitational Waves. But in that case Randall seemed to know about it in advance, as he even changed the normal release schedule to post the comic on the day of the announcement, unlike here, where he seems to have been forced to make a new comic up on the fly.

Stating the obvious, this log–log plot shows that for an object to be an unknown planet it has to be very far away, since planets are big, to explain why we haven't seen it yet. With the log scale it is possible to go from a diameter of less than 1 mm to an astronomical unit (AU) on the Y-axis and from a distance of just 1 cm up to thousands of AU on the X-axis.

Randall's chart is somewhat humorously parochial (if not downright egocentric) in that it purports to measure distance not "from Earth" or from an arbitrary observer, but specifically from himself ("from me"). There is also more detail (e.g. a differentiation between bird, bugs, and skin flora) in the zone closest to the observer, somewhat reminiscent of the classic New Yorker cover illustration View of the World from 9th Avenue.

The distance calculations are somewhat problematic (see more on this below). Close distances seem to be measured from the surface of Randall's body (skin/eyes) rather than from his center of mass. All the planets (and moon) that are marked on the chart are so far away that it will not matter if the distance is measured from Randall's surface, his center of mass, or by the way anywhere on Earth. Also, the planets' diameters are so much smaller than the distance from Earth that their real size would hardly take up any space in the chart due to the log-scale. The dots marking these 7 planets are thus not drawn to scale that should represent their actual size compared with the other planets. But their distance from Earth (and Randall) is not constant even on the log-scale, especially not for the nearest planets, as they can be on either side of the Sun compared to Earth.

The chart correctly states that if there was a planet that was at a distance from him smaller than its diameter, he would be inside it (although at the bottom of that region, it's more like the planet that would be inside him, as this line goes down to a diameter of 1 cm). If the distance is to the planets center, this would also fit if he was only a radius away from the planet. As Randall is not inside the Earth but really close to it, Earth is correctly positioned on this line. However, for Earth, which is marked with the largest of the dots, he seems to have put himself a full Earth diameter away from Earth. Even using the center of mass of Earth as its position he should only have been 6,350 km away from it, but now he places the measuring point of his distance to Earth on the opposite side of the

Earth so his distance to it is equal to its diameter (which would make a choosing a distance of 0 km just as correct). Earth is just left of the 10,000 km line on both axis, and Earth has a diameter of 12,700 km, which will fit fine with the center of the dot, but not with the distance which should have been the maximum distance Randall could be from it (0 or 6350 km depending on the definition of distance from Randall).

The IAU definition of planet requires a solar orbit, gravitational rounding, and "clearing the neighborhood", a controversial (at the time of its introduction) calculation of relative size that excludes Kuiper Belt Objects such as Pluto. The calculation regarding Planet Nine would make it large enough to meet the IAU definition. Using this definition the chart quickly rules out birds and bugs, although at a glance they could be mistaken for planets, something that is especially the case for planes (at night) which are even called fool's planets' in the chart, a reference to fool's Gold. Note that anything that is actually on Earth is positioned within 60 km from Randall. This is because if it is further away he cannot see them due to the curvature of the Earth. This does not mean that he intends to indicate that they cannot be further away from him than that.

The already known planets are prominently marked on the chart. They are the solid black dots. Besides Earth and Planet Nine?, the bottom row of three small dots are Mercury, Venus and Mars. The top row of four larger dots (but smaller than the dot that marks Earth) are (from left to right) Jupiter and Saturn (visible to the

naked eye) and Uranus and Neptune (visible through a telescope).

It is unclear how Randall is calculating these distances, especially to the three terrestrial planets, since neither of these options work: closest approach, average, mean, current or maximum distance. In the comic 482: Height Randall shows (among other) the distance from the Earths surface to all the planets. For especially Venus and Mars he shows that their distance changes a lot based on theirs and Earth's orbital positions. But he has neither used these loops to base the dot size or position, as these loops clearly go closer than 1 AU and only one of the planets are drawn closer than that. It is thus unclear which of the three represents which planet, but in the table below it has been reasoned that the dot situated at the largest diameter of the three inner planets planets should represent Venus (12,000 km) as it is almost twice as big as Mars (6,700 km), which on the other hand is more similar to Mercury (5,000 km) and given that the two dots furthest out are almost the same size, it would make most sense if they represent Mercury and Mars. Since the outer dot never comes closer than 2.5 AU and Mercury never gets further away than 1.5 AU it makes most sense to place Mercury as the middle of the three and Mars as the outer of the three dots.

Below some objects are mentioned that are not on the chart, and also other errors in position (probably due the hasty creation of such a complex comic.) Many of these objects as well as the planets with the errors mentioned clearly revealed can be see in this modified image, which

is also inserted and explained in the trivia section below.

Pluto, no longer considered a planet (it was the ninth until 2006), is not marked on the chart, but it would be below Neptune just outside the pink region (2,300 km diameter and 30-50 AU away). This makes sense since that region is for dwarf planets not yet discovered and any one as big and close as Pluto would have been discovered by now. There are thus also other dwarf planets that would not belong in the pink region, one of them is even much much closer and is easily visible with a telescope: Ceres, which would appear roughly below Mars and Jupiter. (950 km diameter and 1.5-4 AU away from Earth). But this pink region is there to show where there could (and most likely will) still be undiscovered dwarf planets.

The Moon is also marked on the chart, with a gray dot (almost as large as the gas giants dots). The name is written in brackets since it's not a planet (because Earth is clogging up its neighborhood). Randall has messed up the positioning and the diameter of the Moon as it is clearly positioned past a million km, and it is only up to 400,000 km away from the Earth.

The Sun is not marked at all, even though it is extremely prominent, but as it is clearly not a planet it is left out. It would per definition have been at a distance of 1 AU, and with a diameter of 1.4x106 km it would be well inside the region of things that we can see during the day. Note that objects this big will always be shining, already a large planet such as Jupiter is brighter than if it could

reflect 100% of Sun's light. In general, planets ruled out because we would see them during the day refers to objects big enough to be stars or brown dwarfs, but the only star system, other than Sun, that would fit on the chart is Alpha Centauri, which at 4.37 light-years (ly) is well within the right boundary that falls at 5.68 ly, just before the distance to the next nearest star Barnard's Star at 5.96 ly from the Sun. A light year is 63,241 AU, and with the 10,000 AU mark far from the right edge of this log-log plot, it is clear that also 100,000 AU and thus a light year is within the chart. And this also goes for 5 ly.

"Planets ruled out by the WISE survey" refers to the Wide-field Infrared Survey Explorer (WISE), a space telescope designed to look for warm objects such as brown dwarfs, which generate heat at their centers. It was capable of detecting Saturn-sized or larger planets in the outer reaches of our solar system, but did not find any. WISE would not have detected "Planet Nine" (even if it exists) because it is too small and thus too cold to be detected. There is a chance that it can be seen in some more temperature sensitive measurements. But these have not been checked for such a planet yet, (see here).

The word satellites is written on the border of two regions indicating that these can be in both regions. Some are small enough (10 cm) to be comparable to the space junk below, (see cubesats), others are much bigger and would fit in the region above: Stuff we can see through telescopes. Although it may not be called a satellite in daily talk, the International Space Station is in fact a satellite, which is over 100 m in the longest

direction. It would thus be on the border to the Planets ruled out because I would have noticed them above my house region just above the "A" in satellites (400 km above the surface). Some satellites can be seen without a telescope, like the space station.

The title text explains why some people confuse Superman for a bird or a plane, since Superman often flies at the limit between the two categories in the diagram. This is though not really true as can be seen in the bottom of the table below. (This was later referenced in Bird/Plane/Superman.)

Table of items in the chart[edit]

• This table lists the limits of all regions and dots in the image.

Some of the more stretched out regions has also been split into two or three smaller parts.

The planet dots has the limits from the edges of the circle the dots makes used for maximum and minimum limits.

• The table is sort-able, taking care of units even though these change throughout.
• The data has been read out using the image inserted and explained in the trivia section.

The image also shows the "correct position" of the planets and the Moon, and includes other objects discussed in the table and the explanation

Note that superman is also drawn in on this image.

- The wiki links included below may have been used in the explanation above.

They are only used once in this table though, but not necessarily the first time the word is used.

Rather they are used in the section that has most to do with this object

So Earth is first wiki-linked from the Earth dot

And brown dwarfs first from the WISE region etc.

#1634: In Case of Emergency

January 25, 2016

I keep first aid kits in those emergency lockers. Sure, it's expensive to have them installed in the wall, but at least for those ones there's no need to pay extra for safety glass.

Explanation

Sometimes in order to deter vandalism or avoid accidentally moving/setting off something of importance, an important item like a fire extinguisher will be covered behind a wall of glass. "In case of emergency, break glass" - and retrieve the tool.

However the depicted situation is funny, because the thing behind the breakable glass is a glass repair kit. This is ironic, considering that the only way to reach it is by breaking the glass. One might even use it to fix the glass broken to get it... This joke is similar in nature to a useless machine. However, the broken glass that needs to be repaired is an emergency situation, so it is important to have some less important glass to break, to be able to get to the important emergency glass repair kit. In this way it is not necessarily useless, just ironic.

In the title text Randall notes that he keeps his first aid kit in just such a type of emergency locker as shown in the comic. He complains that it is expensive to have them installed in the wall. But then the title text takes a gruesome turn when he continues by saying that at least for those lockers with first aid in them there is no need to pay extra for using safety glass for the cover. Safety glass doesn't break into sharp shards, so would be used for the cover of such an above-mentioned fire extinguisher cabinet, for instance, ensuring that the user will not cut themselves when breaking the glass to retrieve it. But Randall indirectly says that since the person breaking the

glass will soon have access to a first aid kit then, if wounded in the process of breaking the normal window glass, they can as well be treated on the spot - so it will be OK to let them get injured.

First aid kits and for instance defibrillators can be found at frequent places such as bus stations and shopping malls, but never behind a glass that needs to be broken.

#1635: Birdsong

January 27, 2016
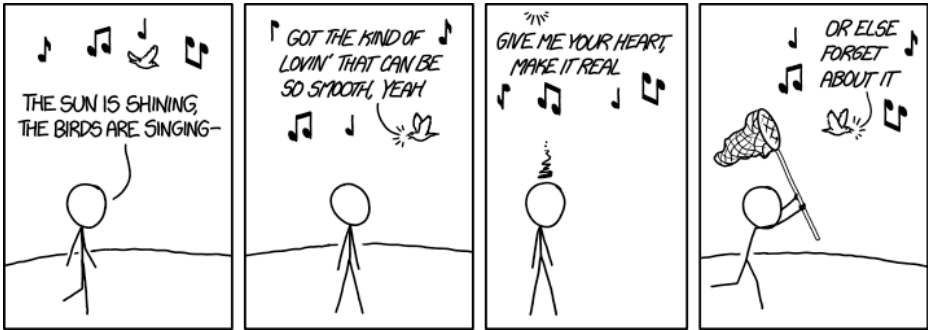
Maybe if I put it in a box for a while with a speaker playing some pleasant pastoral music, I can reprogram it.

Explanation

The comic shows Cueball walking and singing along with the songbird singing above him; Cueball is apparently enjoying the perfect weather and the birdsong as he comments on both. In the next panel, the bird continues to sing but now it sings actual words (to the song "Smooth" (official video) by Santana featuring Rob Thomas). This gives the word songbird a completely new meaning. The bird's singing begins to annoy Cueball, so he chases the bird with a butterfly net in an attempt to catch it. Meanwhile, the bird just continues with the song. (Interestingly, the two lines from the last two panels follow each other in the song, but Cueball manages to get hold of the net in between).

The lines the bird sings are (most) of the last three lines from the chorus (see the lyrics):

• And it's just like the ocean under the moon
• Well, that's the same as the emotion that I get from you
• You got the kind of loving that can be so smooth, yeah.
• Gimme your heart, make it real
• Or else forget about it

The comic is a play on the words bird and song. Songbirds, of course, don't actually sing: the sounds they make are territorial challenges, mating cries, etc. But in Western cultural traditions, particularly the pastoral one, imagining these sounds as 'song' is part of seeing nature

as beautiful and harmonious. Ironically, the fact that this bird is really singing pop music is perceived by Cueball to be an intrusion.

In the title text Cueball suggest playing pastoral music to 'reprogram' the bird, which is of course an even more unnatural intervention - all with the purpose of restoring the pastoral naturalness of the bird. Of course, some birds can actually emulate human words, and in this way also sing real words, like with the common hill myna. Other birds can mimic any odd and unusual sounds, particularly the lyrebird of Australia is known to reproduce all types of sounds from chainsaws to barking dogs and certainly also music.

The title text of "reprogramming" the bird by placing it in a box also refers to B.F. Skinner and his development of programmed learning through his theories of operant conditioning and behaviorism in psychology. By famously using birds in so-called Skinner boxes, he conditioned birds to respond to certain stimuli and expect rewards for particular behaviors, leading to an understanding of many impulsive behaviors in humans like addiction. Cueball apparently hopes to "correct" the bird and its song through this method.
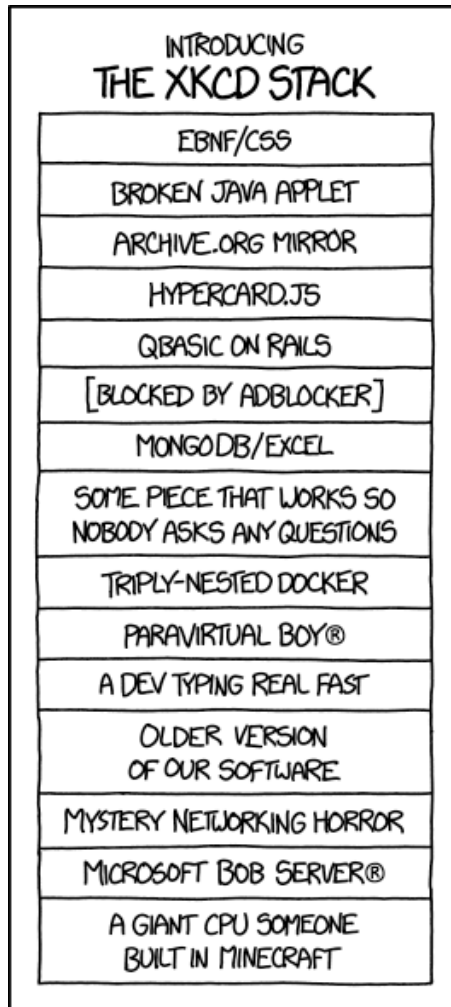
Animal conditioning was also referred to in 1156: Conditioning.

Lately Randall has had his characters catch several things (but never butterflies) with a butterfly net; most recently in 1622: Henge, where it was the Sun that was caught in

the net.

#1636: XKCD Stack

January 29, 2016

INTRODUCING
THE XKCD STACK

EBNF/CSS
BROKEN JAVA APPLET
ARCHIVE.ORG MIRROR
HYPERCARD.JS
QBASIC ON RAILS
[BLOCKED BY ADBLOCKER]
MONGODB/EXCEL
SOME PIECE THAT WORKS SO NOBODY ASKS ANY QUESTIONS
TRIPLY-NESTED DOCKER
PARAVIRTUAL BOY®
A DEV TYPING REAL FAST
OLDER VERSION OF OUR SOFTWARE
MYSTERY NETWORKING HORROR
MICROSOFT BOB SERVER®
A GIANT CPU SOMEONE BUILT IN MINECRAFT

This site requires Sun Java 6.0.0.1 (32-bit) or higher. You have Macromedia Java 7.3.8.1 (48-bit). Click here [link to java.com main page] to download an installer which will run fine but not really change anything.

Explanation

In software engineering, a tech stack is the set of technology platforms and tools that a company or app uses. A common tech stack is GLAMP, composed of a GNU/Linux operating system, an Apache Web server, a MySQL Database, and the PHP programming language. In this comic, the XKCD stack is introduced. The technologies it comprises are either non-existent, unreliable, outdated, or entirely irrelevant.

Another example of a tech stack is featured in 2166: Stack.

Layers[edit]

Title text[edit]

The title text contains several jokes about the Java programming language:

- First, it refers to Java both as Sun Java and Macromedia Java. This is a pun on the fact that older documents refer to "Sun Java" where newer documents refer to "Oracle Java", as if there were two different languages. The fact is that Java was designed originally by Sun and then bought by Oracle, so it "changed name" even though the language is the same. Macromedia was the company that developed Flash before it was bought by Adobe. Both Flash and Java were popular in the early WWW to have interactive web pages, but both are being deprecated in favor of JavaScript.

- Second, the version numbers: older software products used to

have two version numbers: major and minor (e.g. in MS-DOS 6.22 the major number is 6 and the minor is 22). Newer products tend to have hundreds of minor revisions, all of them numbered, so a typical user may well find themselves updating version 6.0.0.1 to 7.3.8.1 without knowing at all the differences between both versions or which other versions are in between. The ¾ in the Macromedia Java version is a joke on complex version numbers, which (so far) have never included fractions.

- Third, the 32-bit or 48-bit version: The Intel 80386 processor used an architecture known as IA-32, which implies the address bus is 32-bit wide and thus able to handle up to 4GiB of RAM memory. This was plenty for the early 1990s, when a typical home PC would have about 8MiB (this is 512 times less than 4GiB). However, about 10 years after that, a typical home PC could well use more than 4GiB of RAM, so several 64-bit architectures were created. These architectures are not compatible (32-bit software may run on 64-bit hardware of the same family, but software compiled as 64-bit doesn't work on a 32-bit system), so programs (including the Java Runtime Environment, or JRE) often have 32-bit and 64-bit versions to allow the most appropriate version to be installed. Furthermore, the JRE is heavily used by many web browsers, and for this to work the JRE and browser need to be the same "number of bits". This means that most people have installed both versions of the JRE to be able to use it with both 32-bit and 64-bit browsers. There's no 48-bit architecture (though some 64-bit processors including the most common ones don't actually use all 64 bits everywhere, ignoring some bits so actual virtual or physical memory is smaller (in the case of the most common ones, 48bits virtual and 40bits physical), they simulate a full 64-bit environment to allow adding more bits later, so there are

no specific 48-bit applications).

- Fourth, the text would suggest that the user has a high enough version to run the software (Java major version 7 is certainly higher than Java major version 6), and yet it informs the user that it must update to a new version. It's possible that the website actually broke as new Java updates have been released, and the user must downgrade to an older version. The cause of the issue is impossible to guess.

- Fifth, an application trying to let the user install a new version of the JRE should direct the user to the download page in the java.com site, not to the main page which deals with lots of issues with java and is not particularly helpful when trying to update the JRE. It may be a common frustration of users to be directed or redirected to the Java frontpage by accident.

- Sixth, and continuing with the joke of users updating from 7.3.8.1¾ to 6.0.0.1 and not knowing why they should, the new version is said to "run fine but not really change anything". This is the usual behavior for Java updates: they run fine (possibly in opposition to 1197: All Adobe Updates, where updating must be done several times and the user is never sure they have installed all the newest updates), but after finished updating the user can't see any difference with the previous behavior, and/or may still be told that an update is required. Considering that 7.3.8.1¾ is bigger number than 6.0.0.1, it can also refer to the fact that the test for upgrading is incorrect and 7.3.8.1¾ is actually newer version or that a downgrade is required for the applet to work properly, because no one fixed it to work with the newer version. It may also refer to the fact installing new Java versions often requires editing environment variables to force the OS to default to the new JRE, which standard users of

an application don't know to do, leading their computer to use the old JRE anyway.

#1637: Salt Mine

February 01, 2016
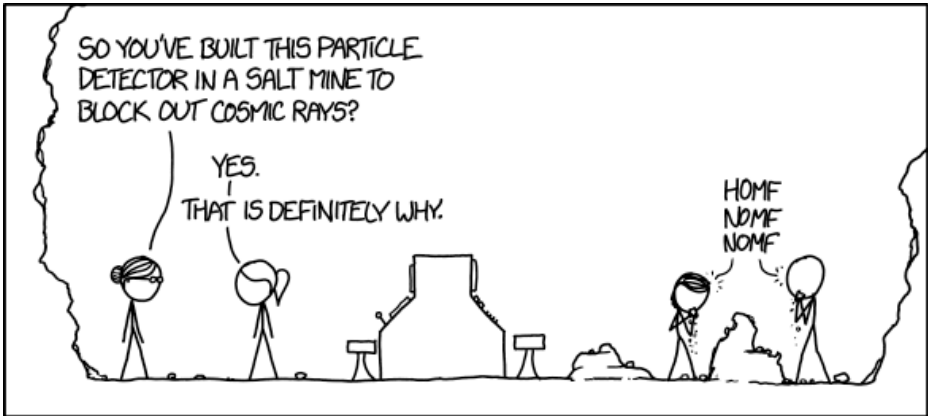
This one is a little bland. Pass the saltshaker?

Explanation

Ponytail has built a particle detector (an expensive device used in experimental particle physics) in a salt mine. Hairbun assumes that this is to block out cosmic rays, as is the case with the real life Irvine-Michigan-Brookhaven (IMB) detector, started in Lake Erie in 1979, or the Enriched Xenon Observatory (EXO), placed in the Waste Isolation Pilot Plant (WIPP) salt mine in 2007.

The IMB detector was initially used to search for proton decay in very pure water kept in the mine, and it was thus important to keep out cosmic rays that would create the same type of signal as a decaying proton. Although the IMB became famous for detecting neutrinos from supernova 1987a (which pass through virtually all materials, salt or lead etc. with only the smallest fraction of them interacting), it never observed a single proton decay out of the 10^{31} protons present in the water of the detector. If it had detected even a single positive observation it would have contributed to the ratification of the Grand Unified Theory, which predicts that protons eventually decay. At the time of this comic the lower limit for proton half-life from experimental evidence is of the order 10^{34} years.

Ponytail affirms Hairbun's assumption; however, based on the wording of her response, it is clear that Ponytail and her colleagues, Cueball and Megan, have an ulterior motive of using the mine to get access to an enormous supply of salt for eating. This is absurd, since salt is

already plentifully available in grocery stores, the cost of the particle detector far exceeds the value of the salt and their intake appears to be far beyond any medically-advised healthy limit (and likely to be sickening in other regards).

In the comic, when Ponytail says "Yes. That is definitely why," it is obvious that when queried about the reason for building the detector, apparently to gain access to large quantities of salt, Ponytail is quick to leap on Hairbun's more scientific-sounding explanation, in an attempt to save face and appear professional.

The title text is intended to be absurd. Salt is normally used to add flavor to otherwise bland foods. However, the "bland" food that the speaker is eating is itself a chunk of salt, and they wish to season their salt with yet more salt. Additionally, the title text's wording is a bit ambiguous; "this one" could refer to the comic itself, and Randall is calling the comic bland. And, in keeping with the subject, is asking for salt to spruce it up, or it could refer to the detector planted inside the mine.

This was the first of two comics this week that concerns one of the basic condiments for food, and also regards one of the five basic tastes. The second, about sugar, was 1639: To Taste. Randall has made several food related comics.

Ponytail's response is very similar to Luke's in 1397: Luke.

#1638: Backslashes

February 02, 2016

```
\             BACKSLASH
\\            REAL BACKSLASH
\\\           REAL REAL BACKSLASH
\\\\          ACTUAL BACKSLASH, FOR REAL THIS TIME
\\\\\         ELDER BACKSLASH
\\\\\\        BACKSLASH WHICH ESCAPES THE SCREEN AND ENTERS YOUR BRAIN
\\\\\\\       BACKSLASH SO REAL IT TRANSCENDS TIME AND SPACE
\\\\\\\\      BACKSLASH TO END ALL OTHER TEXT
\\\\\\\\\\... THE TRUE NAME OF BA'AL, THE SOUL-EATER
```

I searched my .bash_history for the line with the highest ratio of special characters to regular alphanumeric characters, and the winner was: cat out.txt | grep -o "[[(].*[])][^)]]*$" ... I have no memory of this and no idea what I was trying to do, but I sure hope it worked.

Explanation

Most programming languages use the concept of a string literal, which is just a text between some delimiters, usually quotes. For example, "Hello, world" is a string literal. The text being represented is Hello, world without the quotes. However, the quotes are also written to mark the beginning and end of the string. This is a problem when the text itself contains a quote, as in "This is a "quoted" string". The quotes around the word "quoted" are intended to be part of the text, but the language processor will likely confuse it for the end of the string, which would thus be two strings with quoted outside these strings (probably resulting in a syntax error).

To avoid this problem, an escape character (usually a backslash) is prepended to non-string-terminating quotes. So, the previous text would be written as "This is a \"quoted\" string". The language processor will substitute every occurrence of \" with only the quote character, and the string terminates at the quote character which does not immediately follow a backslash. In this case the resulting text string would be This is a "quoted" string as intended.

However, the problem now is that the intended text might contain a backslash itself. For example, the text "C:\" will now be interpreted as an unterminated string containing a quote character. To avoid this, literal backslashes also are escaped with a second backslash, i.e.

instead of "C:\" we write "C:\\", where the language processor interprets \\ as one single backslash and the quote terminates the string to give C:\ as the output.

This doubling of backslashes happens in most programming and scripting languages, but also in other syntactic constructs such as regular expressions. So, when several of these languages are used in conjunction, backslashes pile up exponentially (each layer has to double the number of slashes). See example of a backslash explosion and alternatives to avoid this below.

This kind of backslash explosion is known as Leaning toothpick syndrome, and can happen in many situations. Below is an explanation of all the entries in the comic.

The backslash explosion in the title text is about a bash command (which uses the backslash to escape arguments) invoking the grep utility which searches for text following a pattern specified by means of a regular expression (which also uses the backslash to escape special characters). This leads to 3 backslashes in a row in the command, which could easily become 7 backslashes in a row if the text being searched for also contains a backslash.

Even advanced users who completely understand the concept often have a hard time figuring out exactly how many backslashes are required in a given situation. It is hopelessly frustrating to carefully calculate exactly the number of backslashes and then noticing that there's a mistake so the whole thing doesn't work. At a point, it

becomes easier to just keep throwing backslashes in until things work than trying to reason what the correct number is.

It's unclear whether the regular expression in the title text is valid or not. A long discussion about the validity of the expression has occurred here on this explanation's talk page. The fact that many editors of the site, often themselves extremely technically qualified,[citation needed][citation needed][citation needed] can't determine whether the expression is valid or not, adds a meta layer to the joke of the comic. This is an example of nerd sniping (oh, the irony\!\!\!\).

Entries in the list[edit]

- The first four examples have names that are (somewhat) based on what they actually produce:

Backslash: 1 backslash appropriately named

Real backslash: 2 backslashes are labeled correctly as they do indeed refer to an escaped backslash.

Real real backslash: 3 backslashes would refer to an escaped backslash followed by an unescaped one. The first two backslashes would combine to make a real backslash while the third one would combine with the character following it to form an escape sequence. The name does thus not make a lot of sense, as this is two escape sequences and not a single "very real" one.

Actual backslash, for real this time: 4 backslashes form one single backslash escaped twice (the first escaping produces two backslashes, the second escaping doubles each of the backslashes).

This is so common that even the documentation for the Python regular expression library has a section called Regular expression operations that mentions "\\\\" explicitly. In this case, the backslash has to be escaped once for being part of a regular expression and then each of these once more as the regular expression needs to be written inside a Python string. This is named in reference to the fact that the previous examples didn't contain enough escaping.

- The remaining five examples of backslashes have more and more occult names (explanations) and do not refer to any more real uses of backslash escapes:

Elder backslash: 5 backslashes would be a doubly-escaped backslash plus an unescaped one. The reference to Elder in the comic has many meanings. It has become known through fantasy media; Most prominent with the Elder Days, which are the first Ages of Middle-earth in The Silmarillion, the more-or-less prequel to The Lord of the Rings. More recently it has been used in the Harry Potter universe where the Deathly Hallow called the Elder wand, made from Elder wood, is a very important part of the last book Harry Potter and the Deathly Hallows. Other examples are the Elder Gods of the Cthulhu Mythos as well as various 'Elder' magical items and beings in the Dungeons and Dragons mythologies.

Backslash which escapes the screen and enters your brain: 6 backslashes is a play on the word "escape" as the backslash is supposed to be an "escape character" but obviously not "escaping the screen" and entering your brain. This could also be understood as the programmer getting backslashes on their mind, when they go beyond the Elder backslash domain...

Backslash so real it transcends time and space : 7 backslashes goes further than escaping the screen as they now transcends both time and space

Backslash to end all other text: 8 backslashes would be a triply-escaped backslash (same as 4 backslashes but with an additional escaping layer). It is said to "end all other text", i.e. there should never be any more text if someone uses eight in a row. But there could be more as indicated in the last example.

The true name of Ba'al, the Soul-Eater: ∞ backslashes (11 are shown but followed by "..." to indicate that they continue forever). If you could write an infinite number of backslashes it would actually be The true name of Ba'al, the Soul-Eater. This indicates that if you continue misusing backslashes like this you will end up devoured by a demon, for instance Beelzebub, for being so thoughtless... Ba'al has been mentioned before in 1419: On the Phone and in the title text of 1246: Pale Blue Dot.

Backslash explosion and alternatives[edit]

A reasonable example of a backslash explosion would be a PHP script on a web server which writes JavaScript code with a Regular Expression to be run on the client. If the JavaScript code has to test a string to see if it has a double-backslash, the Regular Expression to do so would be:

where the first two backslashes represent a single backslash and the second two also represent a single backslash, so this searches for two consecutive back slashes.

And the JavaScript would be:

where every two backslashes means just one backslashes in the

string, so the 8 backslashes in JavaScript become 4 backslashes in the Regular Expression.

However, since this JavaScript code is to be written through a PHP script, the PHP code would be:

where:

- The word echo is the PHP command for writing something
- The first quote starts the string
- The RegExp(- including the open parenthesis - is written literally
- The \" following that is a literal quote to be written
- The first two slashes produce one single slash
- And so on until 8 backward slashes are written
- The next \" produces a literal quote character
- The).test(str); is written literally
- The next quote finishes the string.
- The final semicolon terminates the echo command

So, the presented scenario has escalated from a simple test for \\ to no less than seventeen backslashes in a row without stepping out of the most common operations.

If we go a bit further and try to write a Java program that outputs our PHP script, we'd have:

Here, we have 35 backslashes in a row: the first 34 produce the 17 we need in our PHP script, and the last one is for escaping the quote character. (This comes closer to The true name of Ba'al, the

Soul-Eater).

Some programming languages provide alternative matching string literal delimiters to limit situations where escaping of delimiters is needed. Often, one can begin and end a string with either a single quote or a double quote. This allows one to write 'This is a "quoted" string' if double quote marks are intended in the string literal or "This is a 'quoted' string" if single quote marks are intended. Both kinds of delimiters can't be used in the same string literal, but if one needs to construct a string containing both kinds of quote marks one can often concatenate two string literals, each of which uses a different delimiter.

Another feature that seems to be popular in modern programming languages is to provide an alternative syntax for string delimiters designed specifically to limit leaning toothpick syndrome. For example, in Python, a string literal starting with r" is a "raw string" in which no escape processing is done, with similar semantics for a string starting with @" in C#. This allows one to write r"C:\Users" in Python or @"C:\Users" in C# without the need to escape the backslash. This does not allow one to embed the terminating delimiter in the middle of the string and prevents the use of the backslash to encode the newline character as \n, but comes in handy when writing a string encoding of a regular expression in which the backslash is escaping one or more other punctuation characters or a shorthand character class (e.g., \s for a whitespace character). For example, when looking for an anchor tag in HTML, developers may encode the regular expression as <[Aa]\s[^>]*>. If they express this regular expression as a raw string literal, the code looks like r"<[Aa]\s[^>]*>" instead of "<[Aa]\\s[^>]*>". The point here is that "leaning toothpick syndrome" is such a real problem that it

has influenced programming language implementations.

#1639: To Taste

February 05, 2016
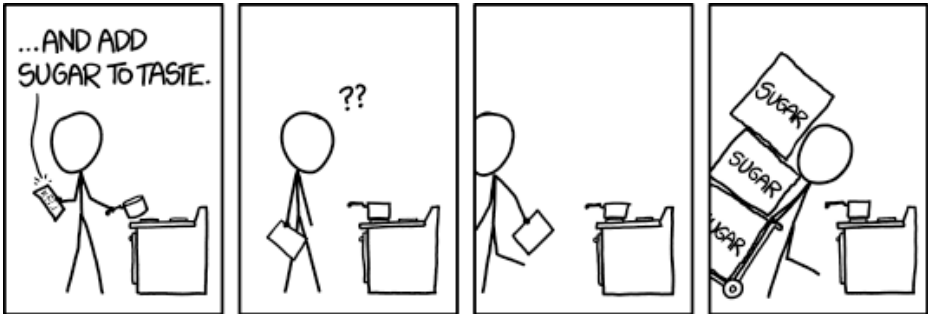
Look, recipe, if I knew how much was gonna taste good, I wouldn't need you.

Explanation

The imprecision of recipes is often a source of frustration to culinary novices, especially the more analytically-minded. Cueball expects a recipe to provide instructions precise enough that by following them carefully, a cook can create a dish exactly as the recipe author intended. Unfortunately, exact replication is impossible in cooking because of the natural variation of ingredients as well as differences in equipment. In addition, most home cooks lack the tools needed to make precise measurements, such as scales and thermometers. Thus, a recipe for strawberry smoothies might read "add sugar to taste" because the recipe-writer can't specify precisely how ripe the strawberries are to begin with. In addition, a smoothie recipe would typically specify imprecise quantities of fruit such as "1 banana" or "1 cup of strawberries" (much less precise than specifying the weight, although at least "1 cup" could be assumed to be a standard volume, that may yield a vaguely similar mass of small rounded fruit when used). Thus, it is impossible for the cook to determine the correct amount of sugar without actually tasting the drink.[citation needed]

The instruction "to taste" can also be used for ingredients that alter a simple aspect of the food's flavor, such as sweetness, sourness, saltiness or bitterness without affecting the quality of the overall dish. Individual preferences can vary wildly and it's not possible for a recipe's author to predict how much the reader will want. Specifying any exact amount in these cases will inevitably

lead to the food being too bland for some, while being too strong for others.

In this comic, Cueball is shown as having no idea how to cook (or having a ridiculously large sweet tooth), and the suggestion that he is going to add large crates of sugar to a small pot is, of course, silly. This would ruin the dish, as whatever was in the pot would be drowned out by the sugar. Alternatively, he could simply bring in enough sugar to make sure he will not run out of this particular ingredient before it reaches the correct level of sweetness for his taste. This too would display a complete lack of understanding about what it is to cook; even a beginner cook should be able to logically deduce that this is far too much sugar.

Another possible explanation would be that Cueball plans to add as much sugar as possible to the dish and eat it, so that he can sue the recipe book's writer for any ill effects he receives as a result. Needless to say, this would be a complete waste of effort - he would probably lose the lawsuit, and even if he won and received compensation money, he would not be able to enjoy it thanks to his ill health.

The title text is Randall's (and Cueball's) personal comment on what he thinks a recipe should do to fulfill his needs. If he knew how much of each ingredient would be appropriate for a given dish, then he would not need the recipe in the first place. The title text actually scolds the recipe for being imprecise. In his view, mixing in imprecise or "use your own judgment" language makes

it less of a "recipe" for the dish, and thus less suitable for those looking for the specific instructions to make the dish because they either have no cooking experience, feel they don't have the expertise to make their own decisions, or simply want to follow clearly defined steps without any decision making required.

This is the second comic this week that concerns one of the basic condiments for food, and also regards one of the five basic tastes. The first one, about salt, was 1637: Salt Mine. Lately Randall has made several food related comics.

#1640: Super Bowl Context

February 08, 2016
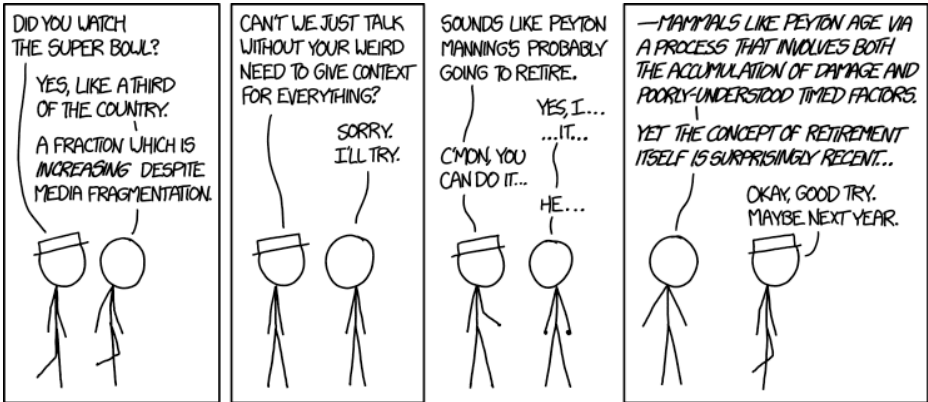
Why did the chicken cross the road? It begins over five thousand years ago with the domestication of the red junglefowl in southeast Asia and the development of paved roads in the Sumerian city of Ur.

Explanation

White Hat tries to make normal conversation with Cueball about the recent (at the time of comic publishing) American football game, Super Bowl 50.

When asking Cueball if he watched the game, Cueball begins with a simple Yes, but then continues to add the contextual fact that about a third of the US population watched the event, which is an incredibly high percentage in today's media landscape. And according to Cueball this fraction is increasing, despite media fragmentation. Thus, even though there are today more and more different ways to watch news, sports and other entertainment, the Super Bowl continues to gain more viewers every year.

It turns out that Cueball has a problem. He cannot just reply to a simple question without trying to put the conversation into some kind of context which does not necessarily have anything to do with the question asked, or at least not with the expected answer. From White Hat's reply it is obvious that he has had conversations like this with Cueball before, as he asks if they could just talk without your weird need to give context for everything?

Cueball feels the need to disseminate any information he finds interesting, even in trivial conversation. Normally people like to have context-free conversations[citation needed] and White Hat invites Cueball to try to fit in with normal people's conversational style.

Cueball apologizes and agrees to try, but even though he really tries hard, with his fists clenched and White Hat encouraging him to just reply normally to a question about the rumored retirement of Peyton Manning, he cannot stop himself from including context in his reply again. White Hat probably wanted Cueball to join in such minimal-context speculation. But, failing miserably again, White Hat finally gives up, and suggests they should try another conversation in a year, when Cueball might have learned to talk about the Super Bowl without context (hence the title).

This time he goes off on a tangent about Peyton as a mammal, and then adding the process of aging and mentioning two reasons for this (which are not well understood). The first he mentions is accumulation of damage, which includes mutations that can lead to diseases such as cancer. The other process he mentions is timed factors which includes telomeres. These have been linked to biological aging because of the shortening of telomeres at each cell division; when telomeres become too short, the cells die (and so do mammals).

To cap it off, he mentions that retiring is a recent concept. But this only makes sense when compared to how long there have been mammals, not compared to how long there have been sports and games, where people could be too old, and thus need to retire long before they would die from old age. Before humans began to enjoy things for fun, the concept of retiring made no sense. You worked/fought for a living, until you got too old and died.

Cueball in this comic may represent Randall, as much of xkcd is spawned from, or occasionally poking fun at, his own hyper-analytical tendencies. And it is also common knowledge that Randall is not very interested in sport, though there are several xkcd comics about American football. The year before this one he made another comic in relation to the final, and in this comic, 1480: Super Bowl, he even mentions the fact that he does not know much about sports in general. So this is the second year in a row a comic has been released in conjunction with the Super Bowl final. But before 2015, there has only been one other comic like this, which was in 2006 with 60: Super Bowl.

The title text continues the joke with Cueball replying to the old anti-humor joke: "Why did the chicken cross the road?" Cueball replies with a preposterous amount of information instead of the cliched simplistic answer: "To get to the other side."

Cueball begins with the origin of chickens. They are believed to be descendants from domestication of the Red junglefowl, which occurred at least five thousand years ago in Asia, as Cueball correctly explains. Before there were chickens, there could not be one crossing a road. It also couldn't be called "crossing the road" without a pavement. The first development of paved roads was in the city of Ur in the ancient Sumerian civilization about 4000 BC (6000 years ago) (also partly explained in Cueball's reply).

As a trivial note, this comic is a rare instance of White

Hat not being the fall guy for the joke. But already in his next discussion with Cueball (1657: Insanity) he was again the butt of the joke.

#1641: Hot Dogs

February 10, 2016

Okay, I'm just gonna order pizza, and let's never talk about this again.

Explanation

A common staple of trite comedy is "why do hot dogs come in packages of ten but hot dog buns in bags of eight?" The phenomenon is mildly frustrating for the consumer, as it often leaves leftover food. The most sinister result is the subsequent purchase of more buns, followed by more hot dogs, followed by more buns, over and over again until forty total hot dogs have been eaten (in a cycle similar to that shown in 140: Delicious).

The actual reason for the mismatch between hot dogs and buns, according to both Karl Smallwood and Cecil Adams, is that meat packers like things that come in pounds and bakers hate things that come in tens. Nonetheless, some smaller companies are starting to offer bags of ten buns, and several brands of hot dogs sell in packages of eight.

Here, Cueball attempts to raise the question as he is standing with a package of hot dogs in one hand and a bag of buns in the other hand (presumably for their dinner), but a person offscreen interrupts him mid sentence and mentions condoms instead of buns. Cueball mulls the subject over in his mind, and when he realizes his friend is putting hot dogs in condoms, he is promptly grossed out.
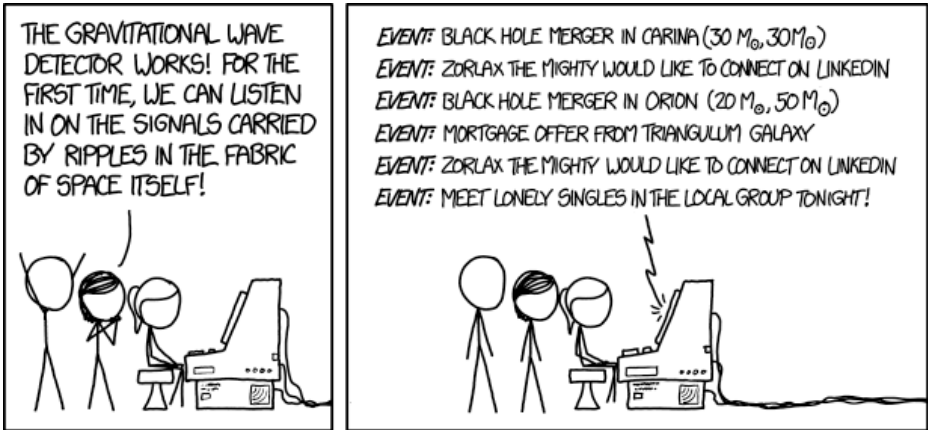
The title text makes it clear that Cueball's new found association of hot dogs with sexual activity, has put him totally off the idea of eating any of them this evening,

and he suggests ordering pizza, which he then can hope will not be used for this similar (NSFW) comparisons... Cueball also asks that he and his friend never discuss this conversation again, due to the situation's awkwardness and uncomfortable subject matter.

The style of the conversation with Cueball asking, someone answering and Cueball saying Eww is similar to a situation in the game comic 1608: Hoverboard where a giant ant queen inside the Destroyer is provoking Cueball in the same way by talking about laying eggs like this:

#1642: Gravitational Waves

February 11, 2016

THE GRAVITATIONAL WAVE DETECTOR WORKS! FOR THE FIRST TIME, WE CAN LISTEN IN ON THE SIGNALS CARRIED BY RIPPLES IN THE FABRIC OF SPACE ITSELF!

EVENT: BLACK HOLE MERGER IN CARINA (30 $M_\odot$, 30 $M_\odot$)
EVENT: ZORLAX THE MIGHTY WOULD LIKE TO CONNECT ON LINKEDIN
EVENT: BLACK HOLE MERGER IN ORION (20 $M_\odot$, 50 $M_\odot$)
EVENT: MORTGAGE OFFER FROM TRIANGULUM GALAXY
EVENT: ZORLAX THE MIGHTY WOULD LIKE TO CONNECT ON LINKEDIN
EVENT: MEET LONELY SINGLES IN THE LOCAL GROUP TONIGHT!

"That last LinkedIn request set a new record for the most energetic physical event ever observed. Maybe we should respond." "Nah."

Explanation

Megan, Cueball, and Ponytail are observing the results from a gravitational wave detector (see details below). This comic came out on the day that the first direct observation of gravitational waves was publicly announced on 2016-02-11. The actual event was recorded five months before on 2015-09-14, but it was not reported publicly before they were sure it was a real signal. It seems that Randall knew in advance about this announcement because this comic was published on a Thursday, not following the normal publish schedule, to coincide with the announcement, and there were no other comics released Friday that week. (The altered schedule could be viewed as a meta-reference to the warping of spacetime.) That scientists knew there might be an announcement on the way, and more details for the interested can be seen in these two videos from Space Time: Have Gravitational Waves Been Discovered?!? and LIGO's First Detection of Gravitational Waves! (See also their follow up The Future of Gravitational Waves).

This is the second time within a month that a new astronomical announcement (of something discovered months before the actual announcement) has resulted in a related comic. The first being 1633: Possible Undiscovered Planets.

From the patterns in the gravitational waves detected by this instrument, it might be possible to guess the nature of the event (e.g. two bodies with dissimilar masses

circling a fixed point, two bodies with equal mass circling each other, collision of two massive bodies, etc.). It might also be possible to triangulate the location of the event. Based on these two facts (the location and nature of the event) we might be able to determine which astronomical bodies caused this event (and the status of those bodies afterwards). Thus, it provides an additional medium to observe the universe in addition to telescopes observing all kinds of electromagnetic radiation. This new medium might enable us to observe properties that we couldn't observe with the rest of our observation instruments.

However, the scientists in this comic appear to be receiving more than the expected signals from black hole collisions, they also receive gravitational spam messages, such as invitations from Linkedin, a mortgage offer, and an announcement of a social meet-up, rather than observing astronomical events (see table below).

There is also a joke on the social meet-up's use of the word local group because the 'Local Group' is also the technical name for the group of galaxies containing the Milky Way.

It is not clear if these so-called "events" are causing gravitational waves to be generated or if something, perhaps an alien civilization, is encoding spam messages in gravitational waves. It is plausible that aliens are using gravity waves to encode their messages, as we do something similar with electromagnetic waves to encode and send our messages. However, it would take an extremely advanced civilization to achieve gravity wave

encoding. It requires the controlling of orbits and oscillations of super-massive bodies like the Sun, or more likely bodies ten times more massive than it. For example, the first event detected, both in this comic and in real life, was a merger of two black holes of roughly 30 solar masses each.

The title text makes the speculation, that something is sending spam encoded in gravity waves, seem more plausible, as it follows up with a joke that the message senders have gone to such a length that they caused the most energetic event recorded ever (perhaps on the scale of a few supernovae or black hole collisions). One of the scientists is so impressed with this effort that he suggests that they actually post a reply, but one of the other person declines with a "Nah"! (As you should always do with spam, else you will just encourage the sender by making it clear that there actually is a receiver on this address.) Randall may have been referring to the fact that the detected event had a power output equal to 50 times that of the entire visible universe.

In 1365: Inflation gravitational waves are also mentioned.

Gravitational waves[edit]

A gravitational wave detector is a device used to measure gravitational waves, small distortions of spacetime that were first predicted by Albert Einstein in 1916. Gravitational waves are ripples in the spacetime fabric itself.

In layman terms, a gravitational wave is like moving a stone

through water while partly submerged. It will cause waves on the surface of the water as it moves through it. These waves will spread away from the center of disturbance and as they move, they will cause the water molecules to oscillate around their mean positions. Similar waves are created in the space-time fabric when two celestial bodies interact with each other. If you concentrate on an area of the fabric far away from the point of disturbance, it can be observed that if the wave causes compression in one direction, it'll cause expansion of the fabric in the other. See this page for nice animations.

Note that anything with a mass will cause a gravitational wave. Just as waves created by small stones are tiny in comparison to waves created by huge rocks in water, the waves from humans moving around will be tiny compared to the waves created by celestial bodies. Also, the bigger the body, the stronger the wave and the farther away it can be detected. That is why we can only detect gravity waves from heavy bodies like black holes or neutron stars but not from us moving around further than around 10m from the test masses. (the LIGO Hanford observatory has also had problems with tumbleweeds hitting the building and had to build a fence).

Now, let's consider spacetime fabric as a thin rubber sheet. If you mark any two points on this sheet and stretch or compress it along the axis joining those two points, the relative positions of these points with respect to their neighboring points do not change, but the distance between them changes.
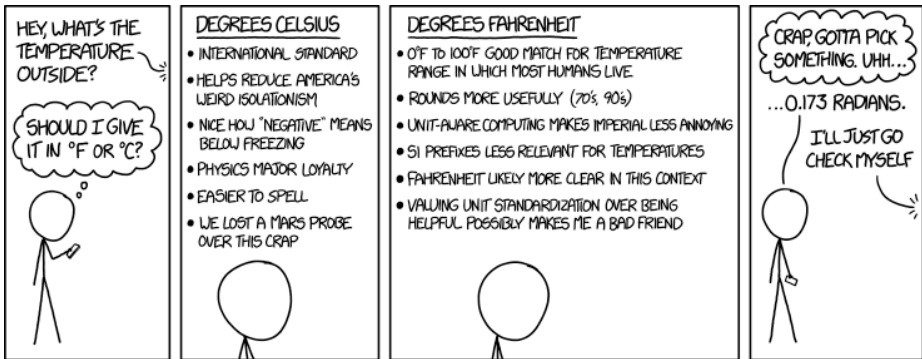
LIGO (Laser Interferometer Gravitational-Wave Observatory) is a large-scale physics experiment designed to detect this compression/expansion, and it was LIGO who discovered the

signal that caused this comic. (For a very detailed description of what the team at LIGO did and the history behind see this 90 minutes feature Gravitational Waves: A New Era of Astronomy Begins from the 2016 World Science Festival).

Two facts need to be remembered to easily understand the experiment. First, the speed of light (c) is constant and the speed of an object is the distance moved divided by the time taken to travel that far. Second, gravitational waves cause opposite effects (compression and expansion) in directions perpendicular to each other. At LIGO, an experiment is set up where two perpendicular long tunnels are constructed with apparatus to emit and detect laser beams. The beam from a laser is split into these two tunnels. After going through the tunnel and back again a few times the beams are brought back together. The lengths of the tunnels are set up in such a way that, in the absence of gravity waves, destructive interference between the two combined beams causes them to cancel one another out, resulting in the detector observing zero light intensity. When the gravitational wave passes through earth, one of the tunnel is expected to expand while the other is expected to compress. Due to the difference in lengths, the destructive interference is incomplete and the detectors will be able to detect the presence of light. This observation can be concluded as "detection of the gravitational wave passing through".

#1643: Degrees

February 15, 2016

Panel 1:
HEY, WHAT'S THE TEMPERATURE OUTSIDE?

SHOULD I GIVE IT IN °F OR °C?

Panel 2:
DEGREES CELSIUS
- INTERNATIONAL STANDARD
- HELPS REDUCE AMERICA'S WEIRD ISOLATIONISM
- NICE HOW "NEGATIVE" MEANS BELOW FREEZING
- PHYSICS MAJOR LOYALTY
- EASIER TO SPELL
- WE LOST A MARS PROBE OVER THIS CRAP

Panel 3:
DEGREES FAHRENHEIT
- 0°F TO 100°F GOOD MATCH FOR TEMPERATURE RANGE IN WHICH MOST HUMANS LIVE
- ROUNDS MORE USEFULLY (70's, 90's)
- UNIT-AWARE COMPUTING MAKES IMPERIAL LESS ANNOYING
- SI PREFIXES LESS RELEVANT FOR TEMPERATURES
- FAHRENHEIT LIKELY MORE CLEAR IN THIS CONTEXT
- VALUING UNIT STANDARDIZATION OVER BEING HELPFUL POSSIBLY MAKES ME A BAD FRIEND

Panel 4:
CRAP, GOTTA PICK SOMETHING. UHH...

...0.173 RADIANS.

I'LL JUST GO CHECK MYSELF

"Radians Fahrenheit or radians Celsius?" "Uh, sorry, gotta go!"

Explanation

Cueball (possibly representing Randall) is being asked by a friend for the temperature. While he is checking his smartphone for the weather, he begins pondering what unit he should use when answering the question. (See below for Cueball's reasoning.)

In the US (where Cueball and Randall are from), the temperature scale used in daily life is Fahrenheit. However, most of the rest of the world uses Celsius in daily life, and even in the US it is commonly used for science. This is also why Randall has previously made the comic 526: Converting to Metric. There are also people who wish the US to change to the metric system, although some of them still wish to keep the Fahrenheit scale as mentioned in 1982: Evangelism

Unlike most areas of measurement, where the metric system is widely considered superior, there is considerable debate about the relative merits of Fahrenheit vs. Celsius. Cueball weighs up the benefits of both scales, but fails to find a solution he can live with, and since he feels he has to give his friend an answer now, he panics and gives the answer 0.173 radians.

Thus, this answer is unhelpful and the joke is that traditionally both geometric angles and temperature are measured in "degrees", but there is no connection between the two.

The title text indicates that Cueball's friend still wants to know whether the answer is in radians Fahrenheit or radians Celsius, which, despite being a silly way to express temperature, would actually enable the friend to get some meaning out of the reply. But this just takes Cueball back to the problem he failed to solve in the first place of choosing one scale in preference to the other, so suddenly he announces has to go and runs off without ever clarifying what he meant. This result is probably because he is afraid of being a bad friend according to his very last point regarding Fahrenheit: Valuing unit standardization over being helpful possibly makes me a bad friend.

The answer Cueball gives of 0.173 radians corresponds to a geometric angle 9.91° (0.173 × 360°/2π). If this were "radians Celsius" it would be 9.91 °C corresponding to 49.8 °F and if it were "radians Fahrenheit" it would be 9.91 °F corresponding to -12.3 °C. Given the temperatures in Massachusetts (where Randall lives) when this comic came out, the day after Valentine's Day 2016, Cueball was probably giving his answer in radians Fahrenheit.

Cueball's reasoning[edit]

#1644: Stargazing

February 17, 2016

Some of you may be thinking, 'But wait, isn't the brightest star in our sky the Sun?' I think that's a great question and you should totally ask it. On the infinite tree of possible conversations spread out before us, I think that's definitely the most promising branch.

Explanation

This is the first comic in the Stargazing series. It was followed by 2017: Stargazing 2 two and a half years later.

This comic opens on Megan as the host for a stargazing TV show, or simply a stargazing tour. She claims to be a doctor, although it is unclear what exactly she's a doctor of. Her remarks, however, may call her professionalism into question. (Originally the host was suspected to be a spoof on Brian Cox, see below, but at some later point Randall changed his official transcript thus making the host female rather than male as in the original version, see the trivia section below. Thus now the host is clearly Megan, which it could not have been originally when the host was described as a man by Randall).

Throughout the comic the host's tone and choice of words becomes increasingly unprofessional, referring to most of the stars as "shitty," personifying them based on different astronomical observations, and providing little useful information on the study of stars or how they work. It seems that this is not an isolated issue as the host mentions that people keep asking her whether or not she is a real astronomer. The host also continuously glosses over the arguably less exciting portions of a typical presentation on astronomy sharing only what she sees as "the good stuff." This penchant for only caring about something if it is interesting extends past astronomy as well as the host is too bored when reading the dictionary to look up the meaning of astronomer.

The comic derives much of its humor from the absurdity of the host's comments on various astronomical bodies. Although not technically incorrect, the way she presents the information is far from informative. (See details below on the host's observations). One of her observations regards the fact that Sirius is a binary star, a system where two stars orbit each other. So even though it is the brightest star as seen from Earth we only really see one of them, as the other is, to quote the host, "not even trying". Sirius A is "large" and "bright" main sequence white star, while Sirius B is a white dwarf with a little under half the mass, 0.49% the radius and only 0.22% the luminosity of Sirius A.

Andromeda is the largest galaxy in our Local Group. It is 220,000 light years across and contains a trillion stars. Humans have difficulty conceptualizing distances of this scale. Suffice to say that it is very large.[citation needed] Betelgeuse is the 9th brightest star visible from earth. One of its prominent features is its visible redness. Within the next million years (or maybe only 100,000 years) it is expected to explode as a supernova, which will certainly be a spectacular sight. It could happen anytime now, and the host hopes it will be in her lifetime. See also 1371: Brightness and 1342: Ancient Stars. Saying cool things about space to make people like you is mentioned in 1746: Making Friends.

In the title text it is mentioned that the Sun is also a star and of course is much brighter than Sirius seen from Earth, and thus Sirius is technically not the brightest star in our sky (although it is in the night sky). The title text

sarcastically encourages the audience to raise that obvious but irrelevant point (a standard joke when people mention bright stars) instead of asking a more interesting, informative, or fruitful question, when there are so many to ask regarding astronomy.

The host's observations[edit]

Here is a list of the host's observations:

Relevant TV-shows[edit]

The comic could be a reference to BBC's Stargazing Live, which Brian Cox has appeared in since 2011. If drawn in xkcd style he would likely look like Megan. He has a PhD in high-energy particle physics, but not astronomy. The newest season of the show aired during January 2016 just a month before this comic's release. Brian Cox has also been the presenter of several other science programs, especially such as the Wonders of the Solar System, Wonders of the Universe and Wonders of Life. Originally the host was described as male in the official transcript (see trivia below), making this seem more likely. For some reason Randall changed the host to female in the transcript later. Very strange, but for sure when he was male, it was obviously a Brian Cox spoof.

It could also be a reference to Jack Horkheimer's PBS shows Star Hustler and Star Gazers. Horkheimer, however, does not at all look like Megan, and he died 6 years ago. But he was not a doctor in astronomy, only getting into it when he started volunteering at the Miami Museum of Science's planetarium. He ended up writing shows for the planetarium and the PBS series developed from there. He rarely covered facts about the night sky that

couldn't be found in any basic reference (possibly because the show was aimed at children and non-astronomy buffs), although he did get more in-depth about current astronomical events such as Comet Hale–Bopp.

#1645: Toasts

February 19, 2016
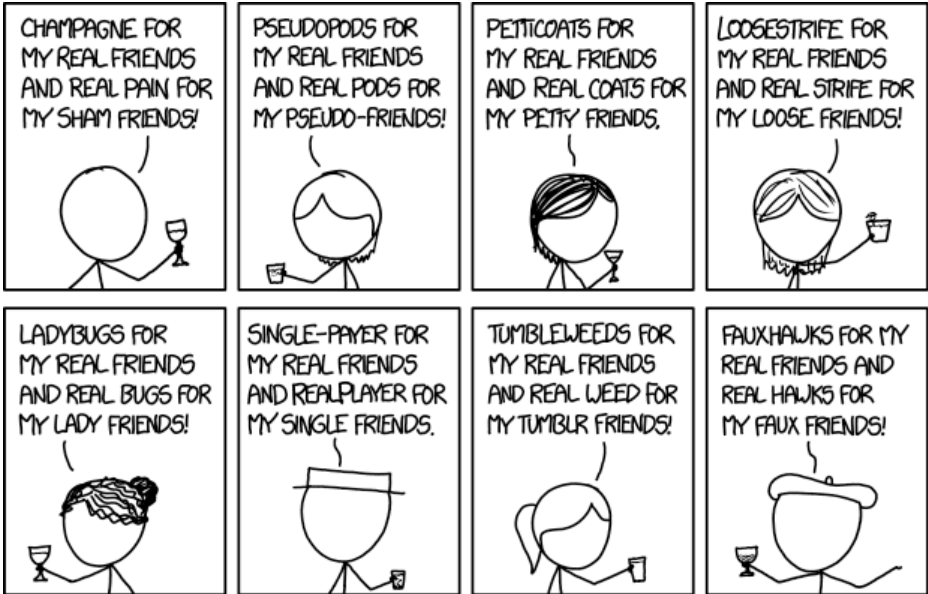
Platonic solids for my real friends and real solids for my platonic friends!

Explanation

A toast is a ritual in which a drink is taken as an expression of honor or goodwill. The term may be applied to the person or thing so honored, the drink taken, or the verbal expression accompanying the drink. Thus, a person could be "the toast of the evening," for whom someone "proposes a toast" to congratulate and for whom a third person "toasts" in agreement.

The comic is based on the quote Champagne for My Real Friends, Real Pain for My Sham Friends which, though often attributed to the painter Francis Bacon or to Tom Waits, is a toast dating back to at least the nineteenth century. It is also the entire title of a song, the ninth track on From Under the Cork Tree, a 2005 album by Fall Out Boy.

The comic plays on a permutation structure between two words (a type of chiasmus), yielding puns with various effects. In this comic eight persons drink a toast for their "real friends" and then for some other type of "friends". For the real friend they wish them to have one specific thing. This something is a word (X-Y) that can be split up in two meanings (X and Y), where one of them are then put in front the word friend, to explain what type of friends they are now toasting (often a bad/false type of friend) and then these friends get a wish for having what the word that are left of the original word means: "X-Y for my real friends and real Y for my X friends"

The first example is a typical toast, in Champagne, where this word can be split in the two phonetically similar words Sham and Pain, and the sham friends then get pain. Below all examples (including the ninth from the title text) are listed with explanation for all words. In some cases the word may actually refer to a drink (like the first with champagne), so that the first word is not something wished for the real friends, but the drink that is in the glass (these have been mentioned below). But for other toasts there is no such drink in existence, and the first word is the thing the toaster wishes for the real friends.

The toasts[edit]

- Champagne sounds like a combination of the two words sham and pain.

Champagne is an expensive sparkling wine.

Sham means false.

Pain is suffering or discomfort.

So Cueball toasts his real friends with Champagne and wishes real pain to his false friends.

- Pseudopods can be divided into pseudo- and pods.

Pseudopods (which translate to "false feet") are temporary cytoplasm-filled parts of the cell wall that are able to change their form in order to move. They are used in some eukaryotic cells to move around or to eat. Most cells that do this are called amoeboids. The amoeba is a common example. There is no drink named Pseudopods!

Pseudo- (lying, false) is used to mark something that superficially appears to be (or behaves like) one thing, but actually is another.

Pods or pod is not clearly defined. It could refer to seedpod – a dry dehiscent fruit containing many seeds. Pods, both malevolent and benignant, appear in many works of SF and Fantasy (for example in relation to "pod people").

So Blondie will give her real friends a special part/adaptation of the amoeba. (Doesn't everyone wish they had pseudopods?) But it at least seems better than her pseudo-friends who would receive real pods with intricate ways to kill them.

• Petticoats sounds like a combination of the two words petty and coats

A petticoat or underskirt is an article of clothing; specifically an undergarment to be worn under a skirt or a dress. There is no drink named petticoats!

Petty means small (in rank of importance), insignificant or narrow-minded. See for instance petty crime.

A coat is a garment worn by both men and women, for warmth or fashion.

So Megan will hand out undergarments for her real friends (a very personal gift) and coats for her less important/insignificant or narrow-minded friends (they seem to be the luckier ones here).

• Loosestrife can be divided into loose and strife.

Loosestrife is a common name for plants within two different genera (which are not related): Lythrum (example: purple loosestrife) and Lysimachia (example: Fringed Loosestrife). There

is a patent for a loosestrife drink but it seems unlikely that this is in the glass.

Loose in this case means free from restraints, as the opposite of close friend. Loose can also refer to being sexually promiscuous, especially when used as an adjective for people.

Strife refers to bitter, sometimes violent, conflict or discord.

So the "brunette" woman (i.e. similar hair but less dark than Megan) will give her real friends flowers and for her promiscuous friend she wishes they end up in a real violent conflict.

• Ladybugs can be divided into lady and bugs.

Ladybugs (or Ladybird) are a family of insects common all over the world. They are considered cute. There also exists a recipe for a ladybug cocktail.

Lady is a civil term of respect for a woman, specifically the female equivalent to gentleman or lord, but in many contexts a term for any adult woman.

Bugs in this case refer to insects or arachnids. It could also refer to the scientific classification Hemiptera, the "true bugs", which does not include ladybugs.

Hairbun toasts her real friends in the ladybug cocktail - it could be a cocktail glass she is holding - (rather than giving the ladybugs for her real friends, even though they are cute bugs that most people are not afraid of). And then she will bestow real bugs (beetles, flies or spiders) to her lady friends. This is not necessarily all her female friends, it could be only those that are noble or at least think they are more important and thus would like to be called lady.

• Single-payer can be divided into single, and payer, a word that

rhymes with player. In this case this word is then put together with real to form the word RealPlayer.

Single-payer refers to single-payer healthcare, a system in which the state, rather than private insurers, pays for all healthcare costs, a system used in several countries, but not so far in the US; it was initially considered but ultimately rejected when the Patient Protection and Affordable Care Act, also referred to as Obamacare by both detractors and supporters of the law, was discussed, passed by the US House and Senate, and signed into law by President Barack Obama. There is no drink named single-payer!

Single refers to a person who is not in a relationship or is unmarried.

RealPlayer is a cross-platform media player app, developed by RealNetworks. It is compatible with numerous container file formats of the multimedia realm. In the past it has been criticized for containing adware and spyware. This was back from 1999 and up to the 2004 version.

It is specifically not the word single-player that is used! This word could refer to video games that only one player can play at a time, or when choosing to play single-player in a game where more could have played. RealPayer is not a word in use.

White Hat thus wishes that his real friends have access to state-funded health care, and all his single friends will get RealPlayer. Since White Hat is normally benevolent, if naïve, he may imagine that RealPlayer will help his single friends enjoy Internet media, when they are home alone. Maybe he wishes to impress these singles with a free app as a present in the hope that he gets lucky. If it has been Hairy this would have seemed very

likely... see 1178: Pickup Artists. White Hat has not previously displayed these tendencies too clearly. As mentioned there have been some issues with RealPlayer in the past, but it has stayed on the market for more than a decade. However, since it has recently been changed into RealTimes it may not be so cool a gift anyway. Also White Hat might wish to give away the old spy ware version of RealPlayer. But as opposed to most of the special type of friends, single-friends is not in itself a negative type of friend, especially not if you are yourself single. So no direct reason to make bad wished for single friends as opposed to sham friends.

• Tumbleweeds sounds like a combination of the two words tumblr and weed.

Tumbleweed is a structural part of the above-ground anatomy of a number of species of plants, a diaspore (of seeds) that, once it is mature and dry, detaches from its root or stem, and tumbles away in the wind. The tumbleweed's association with the Western film genre has led to a highly symbolic meaning in visual media. But there is also a Tumbleweed cocktail.

tumblr is a microblogging platform and social networking website

A weed is any plant considered undesirable in a particular situation, but in this case it refers to Cannabis, also known as marijuana and by many other names (including weed), and would be used (again in this comic) as a psychoactive drug, i.e. to get high.

Ponytail toast her real friends in the Tumbleweed cocktail (rather than giving them a western movie symbol, that will spread seeds all over their house), but with her friends on her favorite blogsite tumblr she will share her expensive weed.

- Fauxhawks can be divided into faux and hawks

Fauxhawks copies the style of a Mohawk hairstyle, but without shaving the sides of the head and not extending past the peak of the cranium. But there is also a Fauxhawks beer.

Faux is a French word for "false".

Hawks is a common name for some small to medium-sized diurnal birds of prey, widely distributed and varying greatly in size.

Beret Guy thus wishes to cut his real friends hair in a very special way, maybe to his liking and thought of as a favor, but not necessarily liked by all his friends, cause although Beret Guy is weird, it seems that those around him are not. His false friends can have a predatory bird (maybe coming after them), but rather knowing Beret Guys love of all things, just as a present of something he likes, like animals. Alternatively he toasts in the beer with that name - could be a fancy beer glass he is holding.

- Title text:
- Platonic solids can be divided into platonic and solids

Platonic solids: In three-dimensional space, a platonic solid is a regular, convex polyhedron. It is constructed by congruent regular polygonal faces with the same number of faces meeting at each vertex. Five solids meet those criteria, and each is named after its number of faces: Tetrahedron (a.k.a. "Regular triangle-based pyramid"), Hexahedron ("Cube"), Octahedron (can be considered the union of two square-based pyramids, base-to-base), Dodecahedron and Icosahedron. There is no drink named platonic solids!

Platonic means not sexual in nature as in platonic love, which is a type of love that is celibate and non-sexual. Platonic friends are friends who will never have sex with each other.

Solid is one of the three fundamental states of matter (the others being liquid and gas). Doing someone a solid can also mean doing someone a favor

Randall, must be speaking the title text and he wishes his real friends to have material in regular, convex polyhedron shape where as his platonic friends can get any other kind of solid material, alternatively a solid favor. Platonic friends are not necessarily bad to have so maybe it should be a positive toast for those as well. On the other hand, sometimes it is one friend that has decided it should be a platonic friendship. In this case the other may regret this and not wish good things for this friend.

'Solids can also refer to solid human excrement.

Platonic can also refer to Platonic ideals, which are models that real-life objects and processes implement only imperfectly.

So while Randall wants his Platonic friends to have solid objects in the imperfect shapes that can exist in real life, he wants his "real friends" to have impossibly perfect hard copies of the regular tetrahedron, cube, octahedron, dodecahedron and icosahedron.

#1646: Twitter Bot

February 22, 2016
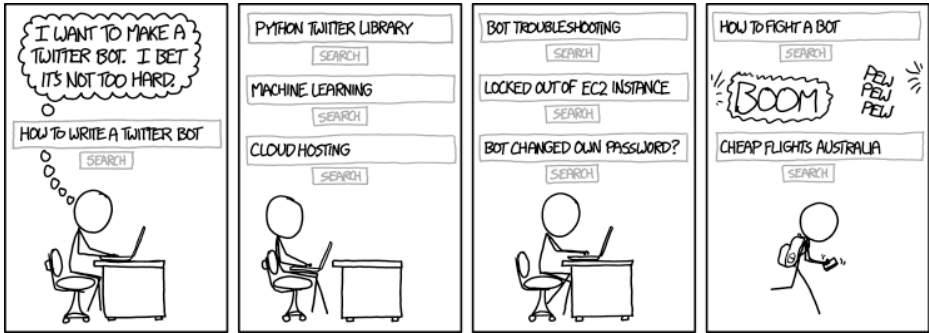
PYTHON FLAG ENABLE THREE LAWS

Explanation

A Twitter bot is a program that can post automatically to Twitter. Although Twitter bots can be very elaborate, a lot of people write simple bots for fun that simply engage in automated wordplay.

Cueball thinks he'll write a Twitter bot, figuring out it won't be too hard. The web searches he makes show what happens next, i.e., the bot balloons in complexity until it starts following its own goals and Cueball no longer has any control over its actions.

This comic examines how a seemingly simple task can often balloon in complexity if all of the requirements are not understood, while at the same time presenting the stereotypical scenario in which an unassuming idea results in the accidental creation of malevolent AI, which then attempts to destroy humanity.

The story, as told by the web searches, is as follows:

#1647: Diacritics

February 24, 2016

Attached please find my résümę̧̊͜!

I USUALLY LEAVE OUT DIACRITICS WHEN I TYPE, SO I MAKE UP FOR IT BY OCCASIONALLY ADDING A WHOLE BUNCH AT ONCE.

Using diacritics correctly is not my fort.

Explanation

A diacritic (or a diacritical mark) is a glyph added to a letter. The main use of diacritical marks in the latin script is to change the sound-values of the letters to which they are added, typically vowels.

Cueball is writing an e-mail (maybe for a job application) and notes in the mail that he attaches his résumé, or curriculum vitae. The word résumé uses two es with an acute accent so they look like this: é.

While diacritics can be common in several languages, English is an example of a language that rarely ever has any at all. This occurs to such an extent that words and expressions borrowed from other languages (such as "résumé" or "piñata") are frequently written in English with the diacritics omitted, as in "resume" or "pinata". As Cueball/Randall is a native English speaker, it is thus natural that he often forgets (or just doesn't bother) to add these diacritics, hence the title of the comic. When he occasionally remembers them, for instance when he types a word where he knows they should be included, like résumé, he then makes up for all those he must have forgotten since last time he thought of it, and thus adds a whole bunch at once. This reason is somewhat nonsensical.

Randall may be poking fun at people who use Zalgo, a form of spam where people continuously spam diacritics in chat messages. For example:

To invoke the hive-mind representing chaos.

Which reads (without the diacritics) as 'To invoke the hive mind representing chaos.'

The first diacritic in the comic could be a macron over the i in "find". In English, this modifies a vowel to be "long". The second (or first) diacritic is the normal acute accent for the e in résumé, to make it an é which does belong in résumé. However, the next diacritic he uses is an umlaut on the u making it into ü, which is not part of the word. Ü typically represents the close front rounded vowel /y/, pronounced similar to the <ee> in "See" but with rounded lips. Ü can be found in languages such as German and Turkish; however, in French ü is not used in this way since the diacritic-less u already represents this sound. German has a word spelt as Resümee, but the meaning is not the same but rather conclusions or abstracts.

Cueball then goes all in on the last e which, like the first e, is supposed to have an acute accent. This e has a cedilla

(as in ę), a ring (as in e̊), three acute accents, and is topped off by a breve (as in ĕ). In total, six diacritics are used on this e alone.

Some languages—notably Vietnamese—can use more than one diacritic per letter, but usually only two (for example, ỗ). This is because in Vietnamese diacritics can serve two functions: the aforementioned modifying sound values as well as to indicate tone. Using multiple diacritics in the comic's fashion makes little sense though it is reminiscent of (the aforementioned) Zalgo text.

There are also three acute accents over the last period. Diacritics over punctuation is not something that is ever used.

So for a word that is supposed to have two diacritics, Cueball uses eight, plus three for the period.

In the title text "not my forté" is supposed to mean that it is not one of Randall's strength or talent. However, to obtain this meaning forte should not have an acute diacritic over the e, thus proving Randall's point that it is not his forte to use diacritics. This is a form of hyperforeignism, where people spell loan words or use pronunciations that they believe is more faithful to the language it comes from instead of the "English" one, even though the "English" one is actually more correct. Due to its similarity with other words from French such as café, some people believe that forte is also spelled with a diacritic on the ending E (also note that the word was independently borrowed twice: from French as "a

strength" and from Italian as a musical term. Neither usage requires diacritics).

The title text may be a reference to the what if? article released a week before this comic, Fire From Moonlight, in which note 9 reads, "My résumé says étendue is my forté" (with the same error on "forte"). It is possible that noticing his mistake was the inspiration for this comic. (Note: étendue, borrowed from French étendue 'spread, expanse', refers to the extent of how much the light from a particular source "spreads out" by the time it reaches the target.)

If there actually has been someone who corrected Randall's mistake in the what if?, then there could be an extra pun hidden in the title. Those who criticized Randall's use of accents, would thus become diacritics!

Comic 1209: Encoding also references an absurd use of diacritics, and later a possible movie called Combining Diacritical Marks was mentioned in 1857: Emoji Movie, a direct reference to this comic. Diacritics is briefly mentioned in 1957: 2018 CVE List and in 3054: Scream Cipher diacritical marks are used as a cipher on the letter A.

#1648: Famous Duos

February 26, 2016

FAMOUS DUOS IN A NEARBY PARALLEL UNIVERSE

THELMA AND HOBBES
WHEN HARRY MET BULLWINKLE
BATMAN AND LOUISE
ANTONY AND ROBIN
ROMEO AND BUTTHEAD
BONNIE AND TED'S EXCELLENT ADVENTURE
PINKY AND CLYDE
SIMON AND GOLIATH
BEAUTY AND LUIGI
BEAVIS AND THE BEAST
ROCKY AND DELILAH
ABBOT AND CLEOPATRA
DR. JEKYLL AND ASHLEY OLSEN
SAMSON AND PUMBAA
BUTCH CASSIDY AND MR. HYDE
BILL AND SALLY'S BOGUS JOURNEY
DAVID AND COSTELLO
SHERLOCK HOLMES AND SILENT BOB
JAY AND DR. WATSON
ANNA AND THE BRAIN
CALVIN AND THE KING
TIMON AND GARFUNKEL
MARY-KATE AND THE SUNDANCE KID
MARIO AND JULIET

The Romeo and Butt-Head film actually got two thumbs up from Siskel and Oates.

Explanation

In popular culture (the term is loosely used in this case) there are many famous duos, such as Calvin & Hobbes (six-year-old boy and his toy tiger, from the cartoon strip with the same name) or David & Goliath (famous past King of Israel and giant, Biblical characters from the Book of Samuel in the Old Testament). (See the trivia section regarding an on-line list of duos).

In this table, Randall describes a fictional parallel universe where the same names are used in different combinations — instead of Calvin, it is now Thelma (from the movie Thelma & Louise) who is paired up with Hobbes, and Calvin is instead paired off with the King, from Anna and the King. In all cases the one mentioned first on the list is also mentioned first in our universe, so it is always of the form Calvin and the King, never Calvin and Anna. There are 24 duos, and all 48 partners are mentioned (they go through four cycles). (In the title text of 1644: Stargazing from the week before this comic, there is an indirect reference to parallel universes/multiverse).

The humor of this comic comes from the ridiculousness of the pairings, and the reader's imagination of the stories that are created with the pairs. See the whole list of real duos as well as the list of alternative duos below, with more detailed explanations.

In the title text, alternative movie Romeo and Butt-Head

is mentioned, the fifth entry on the list. This is a combination of the famous Shakespeare play Romeo and Juliet and Beavis and Butt-Head. Romeo and Juliet has been filmed many times; most recently in Romeo + Juliet from 1996 with Leonardo DiCaprio and Claire Danes in the leading roles. Butt-Head is the less stupid one (of the very stupid duo) from the animated TV series Beavis and Butt-Head (and a film). As Romeo and Juliet is one of the best known love stories and Butt-Head is one of the most disgusting teens ever depicted on the big screen (only overtaken by Beavis), the combination could create disturbing pictures in people's heads (especially in the heads of anyone who may identify themselves with Juliet).

In the alternative universe, when this movie was released, it got the best possible review of two thumbs up from the critics Siskel and Oates. Gene Siskel was paired with Roger Ebert, when they reviewed movies as the famous duo Siskel and Ebert. They were widely known for the "thumbs up/thumbs down" review summaries, with their best combined review being Two Thumbs Up, one from each of them. Coincidentally, or perhaps not, they actually gave Beavis & Butthead Do America Two Thumbs Up.

In the alternative universe Siskel and his partner gives the film a (surprising) two thumbs up, but Ebert has been replaced with Oates. This is a reference to John Oates of Hall & Oates, a famous American musical duo from Philadelphia.

There also exists a comedy duo named Garfunkel and Oates, formed by Riki Lindhome and Kate Micucci, who chose the "Garfunkel and Oates" name by combining the second names from both Hall & Oates and Simon and Garfunkel (the latter duo is mentioned in the main comic). Although this exact combo would not be possible in the xkcd version, as the "real universe" combo takes the second names from two duos rather than the first name from one and the second name from another (as in this comic), there may definitely be a deliberate reference to this group as well which has taken the parallel universe idea into our universe.

List of real duos[edit]

- See the list of alternative duos below.
- In this list the partner index indicates whom the second from the duo is linked with in the comic

So in the case with Thelma (index 1) and Louise (partner index 3), this means that Louise is paired up with Batman (index 3).

Thelma is paired up with the Hobbes who has partner index 1.

List of alternative duos[edit]

- See the list of real duos above.

Cycles[edit]
- There are four cycles.
- The cycles listed below are sorted like explained this example from the longest cycle:

It starts with "Thelma" (from Thelma and Louse), who is paired

with "Hobbes". Hobbes is then shown diagonally down in the next entry below, Calvin and Hobbes, thus leading from "Hobbes" to "Calvin", who is similarly paired with "the King" leading to Anna and so on, until "Batman" is paired with "Louise", completing the cycle.

- First cycle: length 15
- Second cycle: length 4
- Third cycle: length 3
- Fourth cycle: length 2
- Assigning an index starting with 1 (= Thelma & Louise) to 24 (= Mario & Luigi), they can be written as:

#1649: Pipelines

February 29, 2016
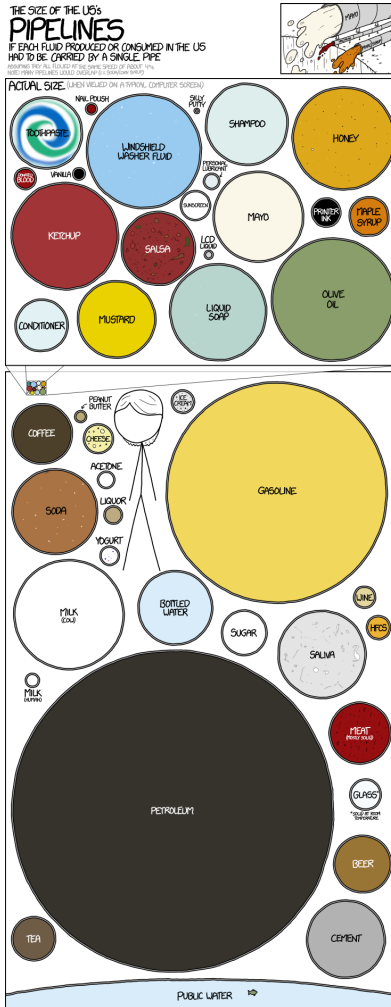
In the future, every single pipeline will lead to the bowl of a giant blender, and we'll all just show up with a bucket each day to take our share of the resulting smoothie.

Explanation

This comic follows a similar idea to the what if? "Niagara Straw" from three days before this comic's release, where the entire water flow over Niagara Falls is imagined to be funneled through a straw (i.e. 7 mm diameter), with disastrous results.

In this comic Randall imagines what size pipes are necessary to carry US domestic production/consumption of various fluids if the flow rate were fixed at 4 meters per second. Randall notes that "many pipes would overlap", owing to the fact that consumption of one item as corn syrup would be due to the production of one of the others, in this case soda pop (another example, than the previous one which is actually mentioned in the comic, could be gasoline which is produced from petroleum).

The top panel is in actual size (something Randall often jokes about, like in the very next released what if? "Eat the Sun", where he shows part of the sun in actual size in the 2nd picture, but in this comic he actually means it). This means that if you look at the image in actual size (or measure lengths in the full size image) then the measured diameter is the diameter Randall has calculated the pipe should be, based on his data for the consumption of these substances.

In the second panel the pipes are too big for his drawing. To indicate the scale he has both inserted a woman

(Blondie) and the top panel has been shrunk down to indicate how much larger the bottom panel is (this is similar to the link between the panels in 980: Money). Using the size of the top panel and the smaller insert, it can be found that the scale is 20:1. The woman is 9 cm tall in the image, which makes her 180 cm — 5 feet 11 inches — in "real life". The pipe next to her for gasoline would have a diameter of 2.2 m.

Since the caption at the top mentions both fluid produced and consumed in the US it becomes very difficult to find out which number Randall uses. For instance the consumption of wine in the US and the production of wine in the US is not necessarily the same as wine is both imported and exported. Should there then be two pipes? Unlike similar comics (like Money mentioned above) there are no references for where Randall has the data for this comic.

As usual with xkcd, the absurdity — and improbability — of routing the entirety of each fluid through a single pipe at any point is the source of humor. Randall appears to assume that all of the fluids would flow at a similar speed to typical water mains (4 meters per second). This is, of course, unrealistic, given the wide range of pipe size and fluid viscosity. Running water through a pipe of that size would be trivial (such speeds are typical), but forcing a material like Silly Putty through a tube that tiny at similar speeds would be implausible. And, as the comic points out, some of the materials are effectively solids at room temperature. Many examples are just plain zany (e.g. saliva may be a reference to another what if? "Saliva

Pool"). Nonetheless, the table gives a good visual representation of the comparative usage rates. Note that at the bottom of the last panel there is a much larger pipe for the tap water used by the public. This should, perhaps, be unsurprising, as water is used a far higher rate than any other substance that we produce or transport. All substances are listed below in the table.

The title text refers to a possible future based on the idea of this comic in which all the pipes with the above-mentioned fluids will actually lead into the same hole as shown in the top right panel. This hole will then be the bowl of a giant blender that mixes all these substances together to a smoothie. The future people will then just come up to this blender and get a bucket full of this mix each day. In reality, this would be an impractical method of getting all of the fluids. Setting the logistical considerations of such a setup aside, this would mean that ketchup and salsa, both intended for human consumption, would be mixed with fluids which are harmful to humans, such as windshield wiper fluid.

Note: "Soup" has been left out, and it might have been expected in this comic due to the similarity to this system with Beret Guy's use of a "soup outlet" as an entrepreneur in 1293: Job Interview. It is probably a larger pipeline than salsa and possibly even ketchup. However, there are many different varieties of soups, and most soup is probably not bought finished, both very good reasons to not include it in the chart. But still the idea of having a soup outlet is very similar to this comic.

Table[edit]

- All the substances are listed here in the "reading" order, also used in the transcript.

- The diameter is for the inner part of the tube.

- GL is short for GigaLiters, or one billion liters. This is strictly the annual discharge of the size (cm) column at 4 m/s.

#1650: Baby

March 02, 2016

I CAN NEVER FIGURE OUT
WHAT TO SAY ABOUT BABIES.

Does it get taller first and then widen, or does it reach full width before getting taller, or alternate, or what?

Explanation

Cueball (possibly representing Randall) is uncomfortable about talking with couples who present their baby to him (here represented by Megan and another Cueball-like guy holding a baby in a blanket). Because he never knows what to say, he has many strange thoughts and/or reasonable questions, that shouldn't be mentioned in front of happy parents showing off their precious baby for the first time. See the table below for his thoughts.

Cueball's thoughts of what he didn't say includes awkward or plain strange lines, musings about science which has nothing to do with this baby, and a rating of the baby. Nonetheless some of the thoughts are quite true.

In the end he manages to make a comment about how cool the baby is, and immediately regrets this, as he just realized he has squandered the chance to say something meaningful and instead has come out with something quite inane.

In the title text he continues his thoughts again, going in the scientific direction with a question regarding how a child grows. Does it get tall first and then put on weight? (i.e. widen). This is a valid question which has no general answer. (See more in the table below). But he is not sure, as he also wonders if instead the child will reach full width before getting taller or alternate stages.

Randall was 31 at the time of the release of this comic. As far as this page and Wikipedia informs, at the time of writing, he has no children, although he is married. However, given his age, it is highly likely that many of his friends are having babies during these years, so he will probably often get into the depicted situation. Therefore, it is highly likely that the comic is based on his own experience, possibly with an added degree of comic exaggeration, and that it is indeed Randall depicted as the thinking Cueball.

Having problems with small talk is a recurring theme in xkcd (see 222: Small Talk), even something as simple as talking about the weather can be a problem (see 1324: Weather). This comic is the third in less than a month were Cueball has issues with this; the first two were 1640: Super Bowl Context and 1643: Degrees.

There has previously been a "plural" version of this comic called 441: Babies, here Cueball also manages to say something better left unsaid, even if it was about his own baby.

Table[edit]

- In the table is a list of all the different sentences Cueball can think of or actually speaks in this comic:

#1651: Robotic Garage

March 04, 2016
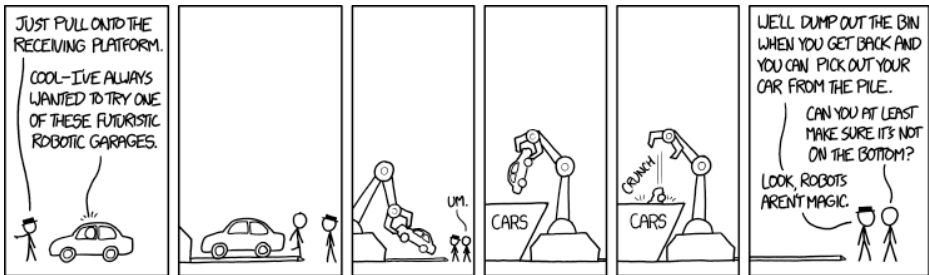
But listen, if getting your car out from under the pile is REALLY important to you, we do have an axe you can borrow.

Explanation

In some cities, automated parking systems (aka robotic garages) are used to reduce the amount of space needed to store cars, as opposed to traditional parking buildings. The robotic system eliminates the needs for ramps and circulation/reversing areas. Normally, they work by having the user drive their car onto an elevator and get out, after which the elevator lifts or lowers the car into a compact storage space. Here Cueball drives up to what he believes to be a garage of this type operated by Black Hat. However, instead of an elevator carefully moving it into a storage space, a robotic claw simply picks up the car and dumps it in a bin of cars.

This type of parking option will not only break the car, but also make it impossible to take out if the car is at the bottom, hence the cars are stacked.

Cueball reacts quite well to this treatment of his car when Black Hat tells him that later they just dump out the bin (full of cars) and he can then pick his own out from the pile. (Maybe he knows Black Hat well enough not to try to argue with him?) This is of course not possible with such heavy objects. Cueball continues to be benign about this absurd situation, which becomes even more absurd when he asks if Black Hat could at least make sure his car is not at the bottom (when it is dumped out with all the other cars). But Black Hat falls back on his excuse "Robots aren't magic," implying that such a feat is beyond the realm of possibility. It would, of
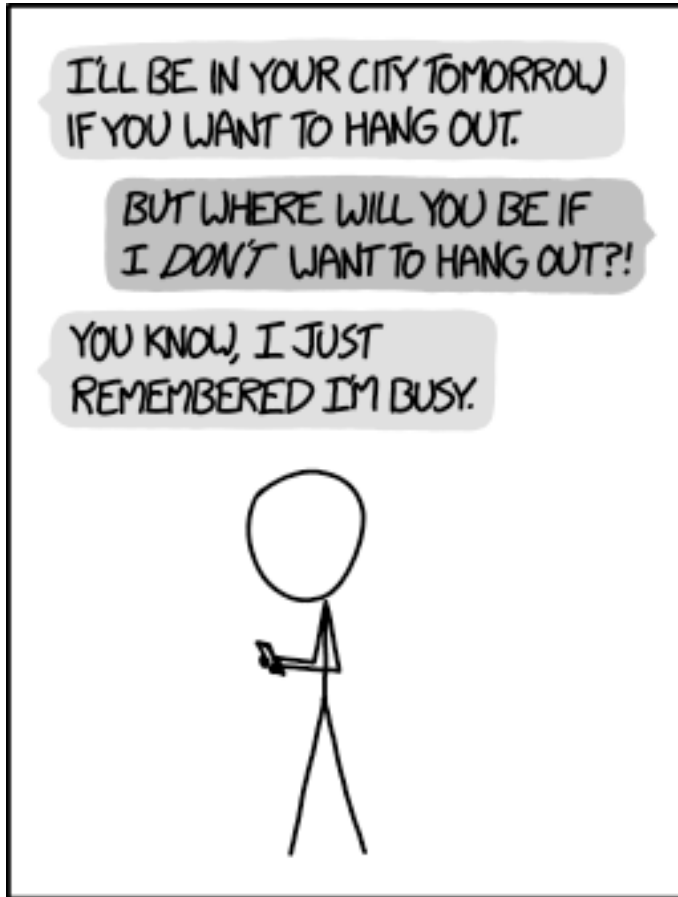
course, be quite possible to prevent the damage that Cueball fears if they were using a normal automated parking system.

In the title text he at least gives Cueball an option: he can borrow an axe, if it is really important for him to get the car out from the pile. Although in this situation, an axe would be a nearly useless tool (which, knowing him, is most likely Black Hat's intent), only allowing Cueball to laboriously hack through any other car that lies in the way on top of his own; and still it would not help much, because if his car is at the bottom, it will be even more destroyed than from just being dumped into the bin to begin with.

This is just one of many situations where Black Hat has an evil or just mean/crazy plan in progress. It's for instance not the first time that Black Hat has treated other people's car with great disrespect, although in 562: Parking, the guy with the car had it coming!

#1652: Conditionals

March 07, 2016

I'LL BE IN YOUR CITY TOMORROW IF YOU WANT TO HANG OUT.

BUT WHERE WILL YOU BE IF I *DON'T* WANT TO HANG OUT?!

YOU KNOW, I JUST REMEMBERED I'M BUSY.

WHY I TRY NOT TO BE PEDANTIC ABOUT CONDITIONALS.

'If you're done being pedantic, we should get dinner.' 'You did it again!' 'No, I didn't.'

Explanation

This comic is about the many different uses of conditional statements in human languages, such as those marked by the English word "if". The most obvious kind of conditional is a statement about conditions and consequences (i.e. causality). An expression such as "If A, then B" amounts to asserting that, if A is true, then B is also true is called conditional probability:

This kind of simple conditional statement is the most common case, and has been adapted for use in computer programming and formal logic. But consider the following statement:

This kind of "bleached conditional" doesn't at all assert that, if the left statement is true, the right one needs to be true. Rather, it's just a way of introducing the right statement (taken as novel) by comparing it with the left one (taken for granted). "As everyone knows, Seattle is always rainy, right? Well, Beijing is smoggy just as often".

So conditionals in language are more varied than those of conditionals when used in logic or programming. Another kind of linguistic conditional is as follows:

No one would understand this statement as meaning "if you want biscuits, they'll magically pop up in the sideboard". The if-clause ("if you want some") doesn't specify the conditions in which the then-clause ("there are biscuits") is true. Rather, it describes the conditions in

which it's relevant. We can paraphrase it as: "If you want biscuits, then you'll be interested in knowing that there are some in the sideboard". If A is true, then it's relevant for us to talk of B. This construction is known to linguists as relevance conditionals, or "biscuit conditionals", due to J.L. Austin's discussion based on the example above.

The humor in the comic is based on the difference between simple conditionals and relevance conditionals. Cueball gets a chat message on his phone to a social event: "I'll be in your city tomorrow if you want to hang out." This is an everyday relevance conditional, with a meaning like: "if you want to hang out, then it's relevant for you to know that I'll be in your city tomorrow".

However, Cueball interprets it as a simple conditional, just as in formal logic. Under this interpretation, the message amounts to a claim that, if it's true that Cueball wants to hang out, then it's also true his conversation partner will be in his city. Cueball is willfully forcing this interpretation, due to his belief that simple conditionals are the only "proper" ones. That is, he's being a pedant. A pedant is a person who is excessively concerned with formalism, accuracy, and precision.

Under this deliberate misreading, if it's true that Cueball wants to hang out, then we automatically know the other person's location. But if Cueball does not want to hang out, we don't know anything about their location; they could be in the city or anywhere else. Since the person is only "guaranteed" to be in the city if Cueball wants to

hang out, he asks them where they will be if he doesn't.

The other person then makes an excuse to drop their invitation, apparently tiring of his pedantry. Hence in the caption Cueball/Randall observes that being pedantic with regard to conditionals is likely to make your friends disinclined to hang out with you. So he tries not to be pedantic about it.

In the title text, the initiator of the conversation presents another "If A, then B" conditional: "If you're done being pedantic, we should get dinner". In most contexts, this kind of "If you're done being X" utterance marks relevance conditionals. Cueball assumes so, and answers "You did it again!". But the reply is "No, I didn't." Which means that this time they're actually using a simple conditional; because, if Cueball isn't done being a pedant, then they think it's a bad idea to have dinner together. And since Cueball was not finished being pedantic about conditionals, then the last no, would probably also end up being a no to having dinner.

The title text (and partly the subject of the comic) is literally a reference to 725: Literally, if you know what I mean.

#1653: United States Map

March 09, 2016

It would be pretty unfair to give to someone a blank version of this map as a 'how many states can you name?' quiz. (If you include Alaska and Hawaii, you should swap the Aleutian Islands with the Hawaiian ones.)

Explanation

The comic is a map with the (rough) outline of the mainland of the United States of America. At first it looks like the real map, but actually all the states have been shuffled around in it. It seems that Randall took all of the states (minus Alaska and Hawaii, the two states that are not part of this map and are only mentioned in the title text, see below), and then reassembled them in the style of a jigsaw puzzle, with the end result being a map with a similar outline to the original unaltered mainland state map. They can thus be reassembled into the real map as can be seen here (see also the trivia section).

Previously Randall has played with the shapes of the United States in 1079: United Shapes. In that map he did two separate drawings for Michigan with a mitten in the lower part and an eagle in the upper part. Once again in this version he has split Michigan in two, the lower main part, the mitten just labeled Michigan, is on the west coast on part of California's location, but the upper part is located on the east coast over New York's location and has been labeled MI (upper). So even without Hawaii and Alaska, there are 49 "states" in this map, consisting of 47 states plus the two halves of Michigan. In the table below all 49 states in the map has been listed to indicate where the puzzle pieces have been moved to.

It seems at a first glance that the names have been written on the states as they would appear in a normal map, and

that they have all then been rotated with the rotation of the states. But this is not the case for all states. For instance it seems like Utah has hardly been moved at all, and with the name written normally this may be intentionally to deceive the readers. Because Utah has been turned upside down, and according to how for instance Texas, clearly turned upside down, has its name written upside down as well, Utah should thus also have been written like that.

California has only been pushed down the length of the west border of the US (and thus rotated accordingly) so the top part still overlaps with the bottom part California, but also covers the bottom part of Arizona and New Mexico. Other states that likewise haven't been moved a lot include Maine which has only been rolled left (i.e. turned upside down) to just outside its normal position. Colorado has been moved up a state to where Wyoming usually is, and Wyoming has then just been shifted right, still covering part of its original position. But both have been turned 90 degrees, whichever way would be impossible to say for these rectangular states, but the text, if you dare believe in that, seems to indicate they have been turned counter clockwise. Wisconsin has only been shifted down below its usual position but then turned upside down.

The title text mentions how it would be unfair to use a blank version of this shuffled-up map as a quiz for knowledge of U.S. geography (the link is to such a map created by a user of this site); most people recognize states primarily by their relative locations, not their shape

(and especially not their shape after being rotated). It also suggests a corresponding mean trick to play if you include Alaska and Hawaii, which are not present in the comic itself, namely to interchange the volcanic island of Hawaii (consisting of 8 main islands and hundreds of smaller ones) with those of the Aleutian Islands, also a chain of volcanic islands (14 large and 55 small) that partly belongs to the US and partly to Russia. The island extends from the Alaska Peninsula. It would thus be possible to even make it difficult to correctly name these last two states, even though it would be obvious to begin with that it must be the two not belonging to the mainland.

#1654: Universal Install Script

March 11, 2016

```
──────── INSTALL.SH ────────

#!/bin/bash


pip install "$1" &
easy_install "$1" &
brew install "$1" &
npm install "$1" &
yum install "$1" & dnf install "$1" &
docker run "$1" &
pkg install "$1" &
apt-get install "$1" &
sudo apt-get install "$1" &
steamcmd +app_update "$1" validate &
git clone https://github.com/"$1"/"$1" &
cd "$1";./configure;make;make install &
curl "$1" | bash &
```

The failures usually don't hurt anything, and if it installs several versions, it increases the chance that one of them is right. (Note: The 'yes' command and '2>/dev/null' are recommended additions.)

Explanation

Most users of computers today are used to simple, easy installation of programs. You just download a .exe or a .pkg, double click it, and do what it says. Sometimes you don't even have to install anything at all, and it runs without any installation.

However, when things are more "home brew", for example downloading source code, things are more complicated. Under Unix-like systems, which this universal install script is designed for, you may have to work with "build environments" and "makefiles", and command line tools. To make this process simpler, there exist repositories of programs which host either packages of source code and the things needed to build it or the pre-built programs. When you download the package, it automatically does most of the work of building the code into something executable if necessary and then installing it. However, there are many such repositories, such as "pip" and "brew", among others listed in the comic. If you only know the name of a program or package, you may not know in which repository or repositories it resides.

The install.sh file provided in the comic is a shell script, which attempts to fix this problem by acting as a "universal install script" that contains a lot of common install commands used in various Unix-like systems. This script in particular is interpreted by the Bourne Again Shell (Bash), which is denoted by the #!/bin/bash in the

first line. In between each of the install commands in the script is the & character, which in POSIX-compatible shells (including Bash, a popular shell scripting language) means it should continue to run the next command without waiting for the first command to finish, also known as "running in the background". This has the effect of running all the install commands simultaneously; all output and error text provided by them will be mixed together as they are all displaying on the screen around the same time.

The script accepts the name of a program or package as an argument when you run it. This value is then referenced as "$1" (argument number 1). Everywhere the script says "$1", it substitutes in the name of the package you gave it. The end result is the name being tried against a large number of software repositories and package managers, and (hopefully) at least one of them will be appropriate and the program will be successfully installed. Near the end, it even tries copying the source code from an online source and then runs several commands which compile/build the program.

All in all, this script would probably work; it runs many standard popular repository programs and package managers, and runs the nearly-universal commands needed to build a program. Most of the commands would simply give an error and exit, but hopefully the correct one will proceed with the install.

One of the more subtle jokes in the comic is the inclusion of apt-get and sudo apt-get in the same script. Good unix

practice dictates never logging in as root; instead you stay logged in as your normal user, and run system admin accounts via sudo program name. This prevents accidental errors and enables logging of all sensitive commands. A side effect of this, however, is that an administrator may forget to prefix their command with sudo, and re-running it properly the second time. This is a common joke in the Linux community, an example of which can be found at this viral tweet which shows a humorous workaround for the issue.

Since Randall's script does not use sudo for any but the apt-get command, there are two possibilities: the script itself was run via the root user or via sudo, in which case the sudo apt-get is not needed, or the script was run as a normal user, in this case the commands may install a local (as opposed to system-wide) version depending on local conditions. For instance, npm will install a copy of the package under $HOME/.npm and pip would work as long as the user is working in a virtualenv (which is standard practice for Python developers).

Sudo has also been used both by Randall in 149: Sandwich and by Jason Fox to force Randall to let him appear on xkcd with 824: Guest Week: Bill Amend (FoxTrot).

The tool curl downloads files from the network (e.g., the Internet). For example, curl http://xkcd.com/ downloads and displays the xkcd HTML source. The pipe | in the script attaches the output of the command before the pipe to the input of the command after the

pipe, thus running whatever commands exist in the web content. Although this "curl|sh" pattern is a common practice for conveniently installing software, it is considered extremely unwise; you are running untrusted code without validation, there may be a MITM who modifies the code you receive, or the remote system could have been hijacked and the code made malicious. Most local package managers (e.g. apt, yum) offer digitally-signed packages that thwart this problem. You can find many examples of software providers suggesting a curl|sh solution at curlpipesh

There appears to be a bug with the & at the end of the "git clone" line; since a git repository typically contains program source code, not executables, it may have been intended to retrieve the source code with git and then compile and install the program in the next line. In this case, the single & should be replaced with &&, an operator that will run the second command only if the first one has completed successfully. This plays into a second bug on the "configure" line, where the placement of the & means that only the "make install" command will be run asynchronously after the "configure" and "make" steps have finished in sequence (though this would likely fail due to a lack for write permissions unless it was run with sudo). To make success as likely as possible, the two lines should be like this or script should be executed twice:

Since all commands are running in the background, any command that requires user input will stop and wait until brought to the foreground. A common request

would be for a database password, or if it is allowed to restart services for the installation. This could lead to packages being only partly installed or configured. (See more about using "yes" below.)

Title text[edit]

The title text mentions the possibility that the same program may be in multiple repositories. In this case, the script may download and install several different versions of the same software. This would likely only create a confusing install-base, as an operating system would tend to prefer to use one version over another regardless of which one functions. It is unlikely that different repositories include the same software, with the exception of pip/easy_install and the two forms of apt-get, which would each likely see the software is already installed and abort. A way to fix this would be to use if statements. An example of this is here.

The title text also mentions that adding a way of automatically saying "yes" to questions asked during the different repository-fetching programs' running, by making them read input from another program that writes a (nearly) endless stream of "y"s, could simplify things further. This would not work for any curses-based menus, or to answer any more complicated questions. Adding 2>/dev/null to a command redirects the second output stream (the "error stream") to the null device driver, which discards all writes to it, meaning errors (the package not existing) will not be sent to the screen.

#1655: Doomsday Clock

March 14, 2016
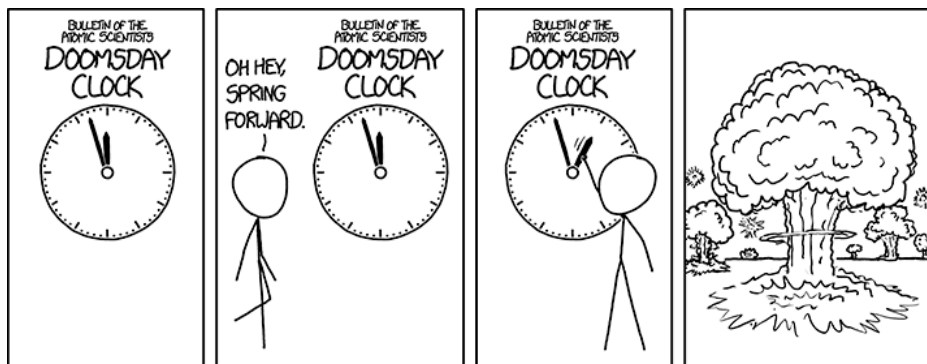
After a power outage at the Bulletin of the Atomic Scientists, the new Digital Doomsday Clock is flashing 00:00 and mushroom clouds keep appearing and then retracting once a second.

Explanation

The Bulletin of the Atomic Scientists is an academic journal which has a recurring feature known as the Doomsday Clock, which shows the Bulletin's judgment on the current state of the world. The idea is that when the clock hits midnight, the world ends (originally conceived as in a nuclear war), so how close the clock is to midnight is a scale of the world's current state of risk. Its setting as of the publication of this comic was at "three minutes to midnight" (11:57 PM or 23:57). Its current setting is (as of the most recent meeting on 28 January 2025) at "89 seconds to midnight" (11:58:31 PM or 23:58:31).

Daylight saving time (DST) is a feature in many countries where in the summer months, everyone moves their clock forward an hour to artificially postpone sunset and thereby have a longer time of sunlight in the afternoon. The day before this comic came out (Sunday), most of the United States switched from standard time to DST. This makes it the first of several comics about DST that has been released in conjunction with the beginning of DST.

Cueball is inside the office of the Bulletin of the Atomic Scientists and comes across the Doomsday Clock, which is apparently an actual clock. Citing a mnemonic, "Spring forward, fall back", referring to which direction to move the hour hand in the season when DST begins or ends, he pushes the hour hand forward one hour, so

instead of the world being three minutes from the end of the world, it is now 57 minutes into it, so the final panel simply shows the world erupting in a Dr. Strangelove-esque nuclear apocalypse, with the typical mushroom cloud shape, with a ring around the stem, which is also displayed in the Wikipedia page on nuclear weapons.

This is an absurdist joke confusing the Doomsday Clock with an actual clock; the Doomsday Clock is a subjective measurement of risk, not of time, and as such is not subject to Daylight Saving Time. Furthermore, in the comic the Doomsday Clock does not just measure the world's risk but actively controls it; even if the Doomsday Clock were affected by DST, the doomsday scenario notably does not occur until Cueball adjusts the clock. Also Cueball would only ever adjust the clock like this, if he happened to come by just when the real time was 12:57 the day after DST (as it is not clear from an analog clock if it is AM or PM). When he spots the clock showing 11:57 at 12:57 he just thinks someone has forgotten this particular clock, (which happens a lot the day after DST), and he is thus just helpfully adjusting to the new correct DST time.

The title text continues on this same theme, with the digital doomsday clock (apparently it has now been replaced by a digital one, maybe Cueball broke the old analog one) being reset by a power outage. Many digital clocks blink 00:00 once per second after a power outage, only stopping when the clock is reset. This is interpreted as the world actually blinking in and out of the

Doomsday Clock's midnight, so nuclear explosions thus naturally appear and disappear in sync with the clock.

This once more underlines the entire point of this comic, that it makes no sense to have such a clock. Many people, including Randall, also believe that DST also makes little sense today, so maybe this is why the two are connected in this comic. Randall has mocked DST several times, so this could be yet another attempt to have some fun at its expense.

Another doomsday clock was used in 1159: Countdown, although here it was for a supervolcano eruption. A nuclear bomb, not yet exploded but with a short countdown, was the facilitator of the joke in 1168: tar.

Within a year before this comics release Randall made several other comics about nuclear weapons, most recently January of 2016 with 1626: Judgment Day, and before that these two in 2015, 1539: Planning and 1520: Degree-Off. Nuclear weapons are also mentioned twice in Thing Explainer, specifically they are explained in the explanation for Machine for burning cities about thermonuclear bombs, but they are also mentioned in Boat that goes under the sea about a submarine that caries nukes. All three comics and both explanations in the book, does like this comic, comment on how crazy it is that we have created enough firepower to obliterate Earth several times (or at least scourge it for any human life). After these there was some time without nuclear bombs, but a new mushroom cloud was displayed in 1736: Manhattan Project, the week after such weapons

invention was listed at 1950 CE.

Most practical clocks will mechanically tie the movement of the hour hand to the minute hand, to ensure 'half past' minutes have a 'half-between' hour-hand rather than confusingly coincide with the hour-hand sitting over any digit (and then half-way between when the minute is near an "o'clock" time). Even if the hour hand is easily moved independently from the front, it is generally good practice to wind the minute hand round fully (to add an hour) back to the correct minute, and instead move the hour hand on that way.

Clocks that can be adjusted by moving the hands (or any other control, such as an adjustment gear n the back of the unit) are also best always adjusted forward (as it is being, in this case), and are best changed for the "fall back" adjustment by sending the minute hand clockwise eleven (or, if relevant, twenty-three!) times round to get 'back' to the hour before.

#1656: It Begins

March 16, 2016

IT BEGINS.

LOCAL NEWS

SEAGULL STEALS PHONE, DROPS IT IN OCEAN

PROTIP: TO MAKE YOUR DAY MORE DRAMATIC, POST A RANDOM MINOR NEWS STORY WITH THE COMMENT "IT BEGINS."

You can also try 'Yikes.'

Explanation

This comic encourages the reader to post random news stories on the Internet, under the line "It begins." This creates a sense of impending doom, as well as making people wonder what, exactly, is being referred to. This could also encourage people to theorize about what, exactly, is beginning. It could also just confuse the intended audience, as they try to comprehend what the author is saying.

This could in the worst case speedily lead to several people making repost of such a non-news story that would not have gotten any attention otherwise. This may lead to speculation, and other curious theories, going out the tangent it could create fear or mass hysteria.

Some stories that might benefit especially from this are those relating to machine autonomy, animal attacks, disease, and so forth. This would call to mind various popular culture and/or scientific hypothetical scenarios.

Perhaps the comic's choice of article refers to Alfred Hitchcock's thriller The Birds, in which birds (especially seagulls) begin attacking humans for no apparent reason, or the broader idea of an animal revolution, or just that even animals get sick of us always looking at our smart phones.

The title text instructs readers to try the line "Yikes" instead. The idea is the same, but it would imply a critical
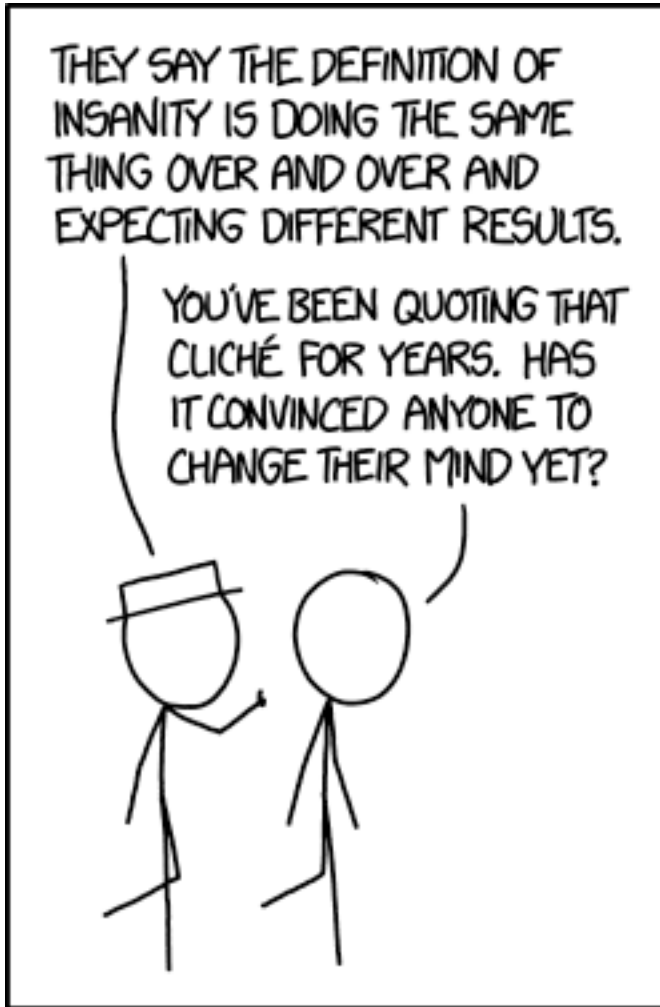
moral stance.

Other comics which advocate using catch-all phrases as standard responses for any comment:

- 174: That's What SHE Said
- 178: Not Really Into Pokemon
- 559: No Pun Intended
- 1022: So It Has Come To This
- 1215: Insight
- 1627: Woosh

#1657: Insanity

March 18, 2016

I looked up "insanity" in like 10 different dictionaries and none of them said anything like that. Neither did the DSM-4. But I'll keep looking. Maybe it's in the DSM-5!

Explanation

In this comic White Hat quotes a famous "definition of insanity" (usually attributed to Albert Einstein, but may be a loose paraphrasing from Narcotics Anonymous) adapted by Rita Mae Brown or others historically.

Cueball's answer applies the quote to the action of quoting that quote. White Hat seems to have quoted that quote quite a few times already, expecting people to change their behavior which hasn't happened so far. So according to that definition of insanity, it is insane to keep quoting the definition of insanity, expecting people to change their behavior because of that.

The title text implies that White Hat would be "insane" according to the quote he used in the comic because he has repeatedly searched for a definition of insanity that matches the one quotes in the comic and of course always gets a negative result, since this is a personal quote not a definition. Besides searching in lots of dictionaries, he also looked in the DSM-4 (Diagnostic and Statistical Manual of Mental Disorders, 4th Edition). The DSM-5 has been available since May 18, 2013 and he plans to look into it, expecting different results. Since he won't find it, he is from the quote insane, but of course since this turns out to not be the definition of insanity then he might not be anyway.

This comic follows a pattern similar to 1339: When You Assume.

For a different view on the topic of repetition in experimentation, see 242: The Difference.

#1658: Estimating Time

March 21, 2016
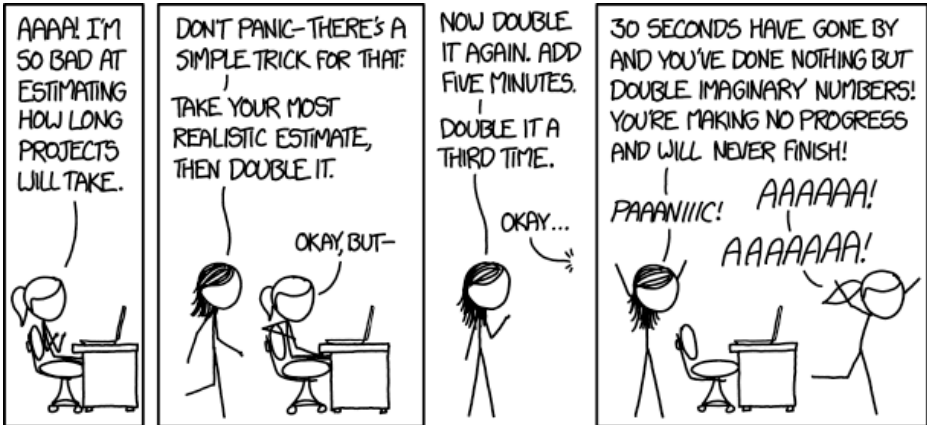
Corollary to Hofstadter's Law: Every minute you spend thinking about Hofstadter's Law is a minute you're NOT WORKING AND WILL NEVER FINISH! PAAAAAANIIIIIIC!

Explanation

Estimation is difficult; many people seem to greatly underestimate the amount of time or other resources required. To illustrate how difficult this estimation is Douglas Hofstadter coined Hofstadter's law which is a non-scientific self-referential time-related adage, mentioned in the title text. It states: It always takes longer than you expect, even when you take into account Hofstadter's Law.

Ponytail is working at her computer and becomes frustrated as it seems her project will (again) take much longer than she has estimated. She is annoyed with herself for always failing to make a decent guess. Danish begins to give Ponytail advice on how to estimate the time, starting with the comforting words don't panic and a common guideline of taking the initial estimate and doubling it.

Danish then iterates the law once more and she tells Ponytail to double this again, and then add five minutes. Unless the project to begin with was estimated to somewhat less than an hour, those five minutes will do nothing but confuse Ponytail. But Danish does not stop here, and iterates Hofstadter's law once more. Ponytail still doesn't get where this goes, saying a hesitant okay to that.

It turns out that Danish was not at all trying to help, but just mess with Ponytail, as she now tells her that the only

thing she has accomplished by listening to her advice is wasting half a minute doubling imaginary numbers (not to be confused with i (aka $\sqrt{-1}$), the imaginary number), i.e. even her first estimate is just something she has imagined especially since she states herself how bad she is at those kind of estimates. Finally Danish completes her frustration of Ponytail by saying "Paaaniiic!", negating the initial advice.

The title text is an extra corollary to the law, that states that using the law to estimate anything about the time your project takes is not only wasted time you could have spent working there is a substantial risk that you will conclude that you will never finish, and thus panic instead of just get the job done now.

Self-reference is a recurring theme on xkcd and this comic is quite self-referential both in the comic but also referring to other comics especially to 917: Hofstadter. He is perhaps most famous for his book Gödel, Escher, Bach from where the quote is taken (in a section on recursion and self-reference, rather than estimation). This book has been directly referenced in 24: Godel, Escher, Kurt Halsey.

#1659: Tire Swing

March 23, 2016
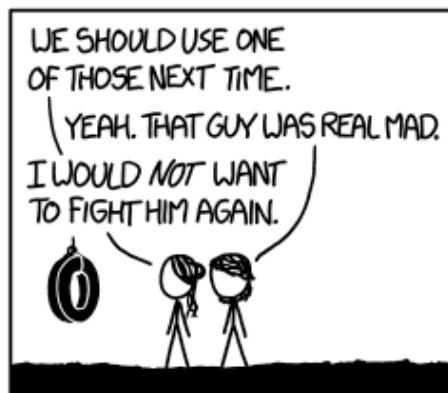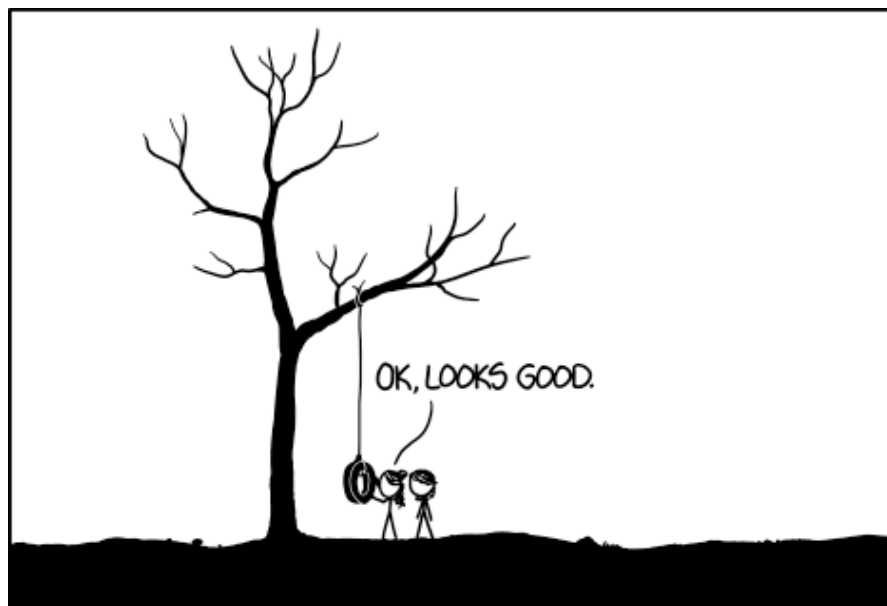
If we find one of those tire dumps, the next time he tries to get his truck back we can just retreat and let him have it.

Explanation

In this comic, Jill and another girl have just completed a tire swing, a common makeshift swing is created by hanging a car tire from a length of rope, typically tied to the branch of a tree as in the comic. The other girl might at first look like she has hair like Megan but not quite as she is revealed upon zoom in to have curly hair. That they are rather small kids can be seen from the size of the tire compared to them. (They could be the same as the girls in the last panel of 1580: Travel Ghost).

In the second panel of this comic Jill muses that there are huge tire dumps filled with nothing but old tires that have no use. In the last panel, Jill continues that maybe they should use a tire from such a dump next time they make a tire swing. The presumption is that perhaps they used a brand-new tire, or a tire from some other source. This is confirmed by the other girl's response (and also by the title text, see below) which makes it clear that the tire they used was in fact stolen from a guy's vehicle. The last reply from Jill suggests the victim put up a fight and they had to take the tire by force. So, these two small girls actually fought an adult man over his truck and won the fight.

Vehicle tires have a limited lifespan. The natural end of their life is when the pattern of raised treads on the circumference of the tire, which promote traction on wet roads, are worn down to a point where they are no longer effective enough, or after 6-10 years (sunlight causes the

rubber to degrade, so the tire becomes prone to cracking and unsafe, even if it appears to be in good condition). Tires can also become damaged in other ways, such as puncture.

Used tires are a notable ecological problem for a number of reasons (e.g., their size, the quantity produced, their relatively short lifespan, and the fact that they are difficult and slow to break down and contain a number of components that are ecologically problematic). A tire swing represents a functional use for otherwise useless old tires. The number of tires (it is estimated that 259 million tires are discarded annually) makes them attractive targets for recycling. More than half of used tires are ultimately simply burned for their fuel value (which prevents them from sitting in landfills indefinitely, but this may even be worse as it releases otherwise locked up carbon thus releasing this into the atmosphere and making global warming even worse). Some steel mills that use electric arc furnaces will mix shredded tires with their scrap when charging the furnace for both the carbon value and fuel value, in place of the coal that would otherwise be used.

The comic is thus clearly Randall's attempt to draw attention to this huge ecological problem, as he so often before has done with other climate change/global warming related comics. (Climate change, especially global warming, is a recurring theme in xkcd). So while this is not the joke of the comic, it could be the point of it.

He also suggests another way to use old tires. It should be noted that used tires are not necessarily safe to use as a kids' toy as they could become sharp/frayed along the edges and stones and other hard/sharp objects may have become stuck in the tires (even going all the way through), during its life span, or worn thin enough to tear apart mid-swing (when the stresses on the swing material would be at their peak). So, tires bought for use as a swing may even be made from a new tire, but not necessarily of the same solid type as those used for cars. Used tires reused for a swing should be inspected for the problems mentioned above.

The title text goes further, suggesting that they actually stole the victim's entire truck - possibly just to harvest the tire needed for the swing - and that he unsuccessfully attempted to recover the truck, so they probably did fight him. He put up enough of a fight that they do not wish to fight him again (so he at least survived). Further, since the girls expect him to try again (maybe recovering the truck without all its tires), they apparently still have the truck. One of the girls suggests that if they could find one of these tire dumps, then they could take a tire from there, make a new swing, and then just walk or run away from the truck when the guy comes back, letting him have it if he really wants it so bad.

The reason Jill made this swing could be that she wishes to become a cosmologist as a reference back her meeting a cosmologist on a tire swing in 1352: Cosmologist on a Tire Swing.

Note that Calvin and Hobbes, which has often been referenced in xkcd, has done the same to Calvin′s father as the girls did to the guy (though without the violence) in a similar comic.

This was the first of two Wednesdays in a row where Randall used two children to make a reference to an environmental issue, the second being 1662: Jack and Jill about fracking also with Jill.

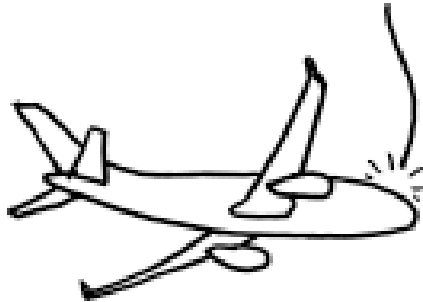## #1660: Captain Speaking

March 25, 2016

Oh dang, you have to pay? Hey, has anyone else paid already? If so, can I borrow your phone for a sec?

Explanation

At periodic intervals on a commercial flight, the captain of the plane will address the passengers with information about the flight. Typically this will begin with "This is your captain speaking..." and go on to describe the progress of the flight, expected arrival time and other information about the flight such as if or when refreshments will be brought to passengers.

This comic takes this cliché and inverts it. Instead of the captain providing information, the captain tells the passengers that he has apparently forgotten everything about the flight, even down to what kind of plane he is supposed to be flying – although he does think it is a Boeing. He at least discovers the flight number and then plans to use the consumer app Flightaware that is made for tracking flights. He thus hopes to be able to find out what the destination of "his" plane is. But Flightaware requires Wi-Fi access, so he goes on to ask the passengers if anyone know how to access the Wi-Fi. This app was earlier referenced in 1363: xkcd Phone.

This even gets worse in the title text where he realizes that you have to pay for using the on-board Wi-Fi, which means he is trying to access the same Wi-Fi that the passengers have access to instead of using the on-board Wi-Fi that must be in the cockpit (to which he is supposed to have free access). Instead of just paying he then asks the passengers if someone has already paid, because then he would like to borrow their smartphone

so he can check the Flightaware app to find out where they are going.

Options for explaining this scenario are:

Seeing as how planes cannot take off on auto-pilot (nor can they taxi, but some can actually land), and require a skilled, awake human at the controls, it is unlikely that this captain was responsible for take-off; which must mean this auto-pilot is much more advanced than current models, likely a future model, or that their first officer took off and then went away or asleep. In the event a pilot falls asleep, on medium sized planes, ground- or proximity-, radar would set off an alarm waking the captain if they are on a collision course.

Whilst it is normal for the captain to sleep part of a long flight, this can only occur if there are multiple pilots on the plane. Most flights are on auto-pilot for hours at a time, and the pilots serve primarily for takeoff, landing, and emergencies. They are completely clueless, having to use a consumer app and asking the passengers to get flight details, instead of radioing for help as he probably should. They would easily be able to get the information of where they are going by just asking any of the passengers though.
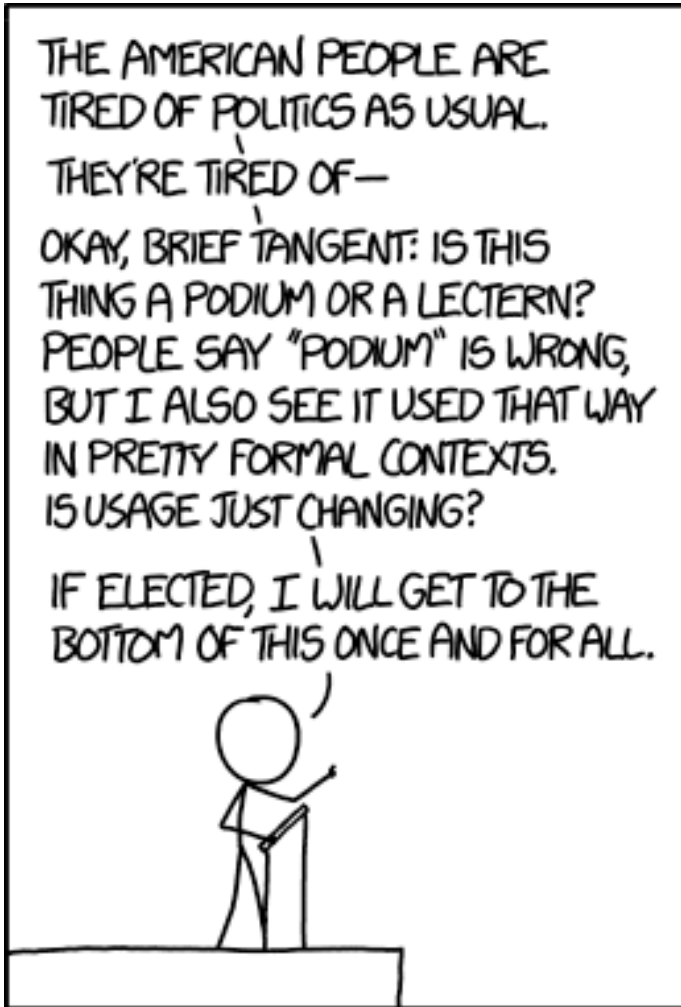
The fact that the captain is not sure of the flight number is not hard to imagine. Commercial pilots fly multiple flights per day and the numbers all run together after a while. Every radio communication starts with the flight number, but if the captain has been out of commission

for some time, the flight number could easily be forgotten. However, he would probably know the aircraft type, as commercial pilots are type-rated for a specific aircraft type and with rare exceptions (e.g. Boeing 757/767) the type is specific to an airframe type. This makes it more likely that he is not professionally qualified, although he could just be rated for so many types of aircraft that it takes him a moment to determine which one is at hand (though such a veteran pilot would be unlikely to have slept through takeoff or forget how to look up flight information from the cockpit).

Three weeks later another plane related joke was released with 1669: Planespotting where it is also an open question if the plane in the comic is actually a Boeing plane...

#1661: Podium

March 28, 2016

THE AMERICAN PEOPLE ARE TIRED OF POLITICS AS USUAL. THEY'RE TIRED OF—

OKAY, BRIEF TANGENT: IS THIS THING A PODIUM OR A LECTERN? PEOPLE SAY "PODIUM" IS WRONG, BUT I ALSO SEE IT USED THAT WAY IN PRETTY FORMAL CONTEXTS. IS USAGE JUST CHANGING?

IF ELECTED, I WILL GET TO THE BOTTOM OF THIS ONCE AND FOR ALL.

BREAKING: Senator's bold pro-podium stand leads to primary challenge from prescriptivist base.

Explanation

A "podium" is a small platform like the one Cueball is standing on. This word originates from Greek podion meaning foot.

A "lectern" is a stand for holding notes, like the one Cueball standing behind. In American English this stand may be also called a podium, which is not backed up by etymology. See podium and lectern in Oxford Learners Dictionaries. In medieval universities, the "lecturer" was not someone who gave talks, but literally one who read from the lectern, the latin root meaning "To read" - Lectio.

The comic is playing on a stereotypical politician, without any real beliefs, here represented by Cueball, but they want to appear to stand for something. Alternatively, this is what might happen if someone like Cueball (or the strip's author Randall), who tend to think literally and who get interested in and distracted by tangents, were running.

Thus, Cueball picks up what is, in some American circles, an argument: whether the standing desk used by public speakers should be called a "podium" or a "lectern." This argument is actually common among members of Toastmasters International (see more here), though it would usually not rise to the level of needing to be part of a national discourse. And it is not only the Toastmasters that care about this.

The fact is, though the etymological definition is clear - the lectern is the desk that stands on the podium - and while the difference might be important if you were setting up an auditorium, in common American usage, it doesn't really matter.

The title text is presented as a breaking news that implies that a senator has taken a bold stand on the subject of podium vs. lectern (presumably Cueball, although it could also be someone else who has been rallied by Cueball's speech). The senator is pro- podium, meaning that he thinks the lectern should be called a podium. This leads to the people who follow a prescriptivist position to organize and put forward a political candidate to challenge this senator in the primaries.

The prescriptivist position relies on rules rather than on usage. In this case a prescriptivist relies on etymology and would thus be pro-lectern. In the U.S., the primaries are used to select a single candidate from a particular party to represent that party at final election (whether national or on a state level). At the time of this comics release (2016-03-28) the United States presidential primary elections to determine the candidates for the United States presidential election, 2016 were in full progress and not at all determined yet.

The title text is also a pun, as 'stand' is another word for an object like a lectern (e.g. as used by musicians to hold sheet music), and 'base' a word for something a stand or lectern might be placed on, as is a podium.

It is unclear from this comic which position Randall favors. He likes that rules are followed, but he also likes that it is easy to talk with people, especially friends. This was recently displayed in 1643: Degrees, see especially the last "benefits" in the third panel.

#1662: Jack and Jill

March 30, 2016
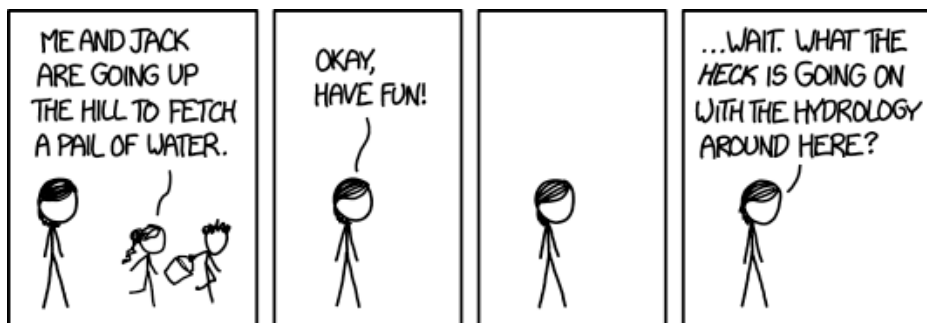
Jill and Jack / began to frack. / The oil boosts their town. / But fractures make / the bedrock shake / and Jack came tumbling down.

Explanation

"Jack and Jill" is a traditional English nursery rhyme. The rhyme dates back at least to the 18th century, one version even with 15 stanzas.

The first and most commonly known verse is the one referenced by Jill in the comic as she says the first three lines:

The comic makes fun of the counterintuitive idea that Jack and Jill go up a hill to fetch water, because natural water sources like rivers and streams flow downhill, making them usually found in valleys rather than on top of hills. Thus, it shouldn't be necessary to have to go up a hill to get water. Similarly, if the water is coming from a well, then building a well at the top of a hill seems an odd choice to Megan. The groundwater table stays at about the same level over smaller areas, so building a well on a hill should require digging further.

However, Megan is probably not aware that since groundwater tends to flow in a similar direction to the slope of the land, it is often considered safer to dig a well uphill from potential sources of runoff (such as outhouses, fields, or septic systems) that may flow down into the underlying pedosphere and porous bedrock below (and perhaps that also being above further impermeable geological layers, as can be seen revealed in instances of spring line settlements). In times when populations were more predominantly rural, and

probably when the poem was composed, "Always dig your well uphill from the outhouse" was a well-known maxim. Moreover, since it takes more energy to bring water uphill from a well (especially in a pail), there is a long-term advantage to having wells higher than main residential areas, as opposed to lower. (This principle explains why water towers are used, even in cities.) Finally, artesian wells deliver water from confined aquifers, which can sometimes be as close to the surface at higher elevations as at lower ones, easier to access through thin hill-top pedosphere than through deep residual alluvial flood-plain deposits or even only present in the zone of a particular geological fold that helped form the foothill or plateau being described. It is also known for a fortified position upon a defensible high point to have dug an internal well, as proof against potential sieges, and perhaps such a useful feature is still the most convenient maintained source - even long after the defensive structure has been abandoned. But Megan may get water from more modern sources, such as a mains water supply grid, and is not familiar with the principles of well placement that Jack and Jill are particularly accustomed to in this instance.

This all said, the predominance of drawing Jack's and Jill's well at the peak, which is rarely the best place to put any well, makes Megan's (and Randall's) comment understandable. Alternatively, the nursery rhyme may refer to a dew pond (which is more likely to be at the peak than a well), another concept that Megan would not be familiar with, having not grown up in the English

countryside.

Title text[edit]

The title text is Randall's own version, a parody of this first verse, where the names have been switched in the first and last line:

This version, which may explain why they went up the hill after water, connects the idea to hydraulic fracturing (colloquially "fracking") methods for oil and gas extraction. In these methods, highly pressurized liquids are forced into a given ground stratum (or layer). With enough pressure, the stratum starts to deform and crack. This allows potential gas and oil to flow more freely. The liquid used for fracturing usually also contains materials like sand or ceramics which, once the liquid is removed, will help to maintain the newly formed cracks so as to further allow the desired free movement of oil and gas.

A common side effect of this method is that water levels and presence at the surface might be modified. In this comic, water can now be found at the top of the hill. This goes against the usual laws of hydraulics, themselves subject to the laws of gravity, which indicate that water should go down through ground cracks. Thus, water is usually found at the bottom of valleys or hills. But in the comic, fracking at the bottom forces the water up, thus explaining why the kids get water up the hill, which, as Megan points out, is messed-up hydrology. Also, fracking may cause induced seismicity in the form of microearthquakes, as alluded to in the title text, which is the cause for tumbling down in the title text version.
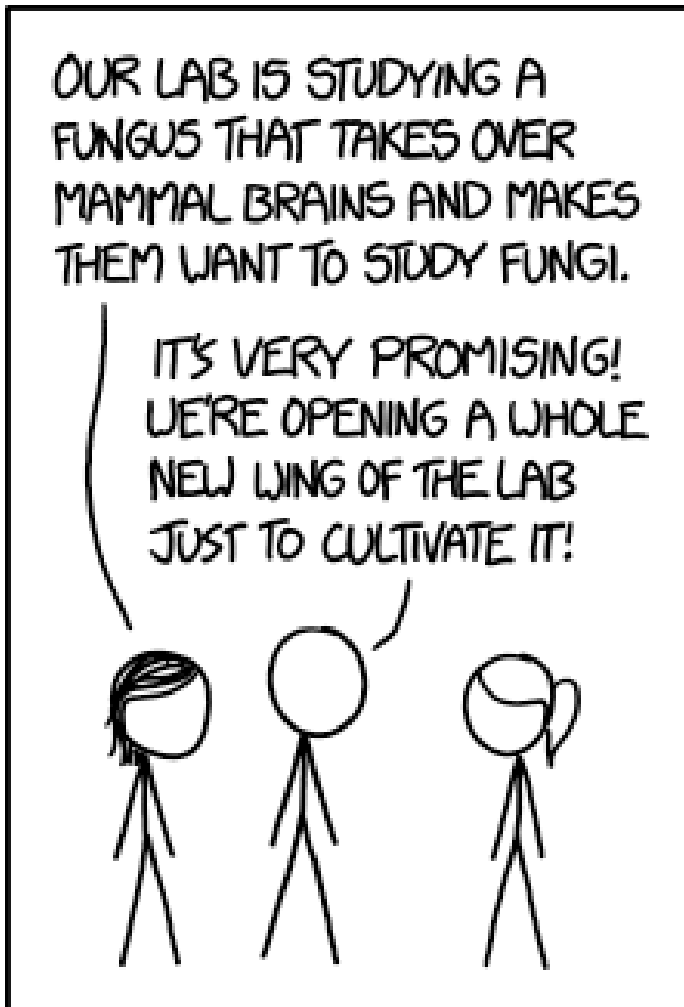
Related comics[edit]

This comic suggests that Randall did not know it is practical to

have a well on top of a hill. However, he has previously drawn wells on hills in 561: Well and more obviously in 568: Well 2, although this well presumably does not contain any water. He has also previously composed another version of this poem, which was published in Five-Minute Comics: Part 4:

#1664: Mycology

April 06, 2016

OUR LAB IS STUDYING A FUNGUS THAT TAKES OVER MAMMAL BRAINS AND MAKES THEM WANT TO STUDY FUNGI.

IT'S VERY PROMISING! WE'RE OPENING A WHOLE NEW WING OF THE LAB JUST TO CULTIVATE IT!

Conspiracy theory: There's no such thing as corn. Those fields you see are just the stalks of a fungus that's controlling our brains to make us want to spread it.

Explanation

Cueball and Megan are studying a fungus that takes over the brains of mammals and makes them want to study the fungus. This is a reproductive tactic by the fungus, since the fungus makes the mammal whose brain it took over want to study the fungus, which means that mammal will need to produce more of the fungus to study it. Cueball and Megan are most likely themselves being controlled by the fungus, since they tell Ponytail that they want to cultivate the fungus as much as possible.

The title of the comic refers to Mycology, the study of fungi.

This is likely a reference to various parasitic species of Cordyceps fungi, which can infect the brains of insects causing behavior advantageous to the reproduction or spread of the fungus. This also may be an allusion to another fungus, Ophiocordyceps unilateralis, which manipulates its hosts to aid its propagation.

Toxoplasma gondii is also known to alter the behavior of mammals, and some researchers have proposed that this parasite may be partly responsible for the "Cat lady" phenomenon, whereby humans are compelled to hoard cats. The comic and its subtitle may, in fact, be a subtle argument that human behavior, and the entire concept of free will, may need to be re-evaluated given the massive numbers of Human parasites known to exist.

In evolutionary biology, the phenomenon of an organism influencing its environment, sometimes by modifying the behavior of other organisms, is known as "the extended phenotype". Richard Dawkins wrote a book of that name (as a follow-up of "The Selfish Gene") where he describes this mechanism as an extreme example of the so-called selfishness of genes.

The title text parodies numerous conspiracy theories, by suggesting that corn, which has been propagated by humans throughout large parts of the world, is actually just a fungus that has used humans, and is not a grain at all. This type of theory is remarkably similar to the Brain in a Vat thought experiment, and to the Isaac Asimov short story Each an Explorer. In both cases something has affected the perception of the mind itself, making it impossible to discern the true reality of something.

This is quite similar to an argument made in the book Sapiens. Author Yuval Noah Harari points out that domesticated crops are among the most successful life forms on the planet, in terms of propagation. These plants have influenced humans to do everything in our considerable power to spread their seeds, eliminate competing plants and animals, and even provide fertilizer and irrigation to help them grow and spread. From the perspective of the plants, they've domesticated us, rather than the other way around. This differs from Randall's conspiracy theory, in that domesticated plants provide us with food in exchange for propagation, making this more like symbiosis than parasitism.

Conspiracy theories are a recurring subject on xkcd.

#1665: City Talk Pages

April 08, 2016

I LOVE READING THE WIKIPEDIA TALK PAGES
FOR ARTICLES ON INDIVIDUAL CITIES

CONTENTS [HIDE]

1 ORIGIN OF CITY'S NAME?
    1.1 IDEA FOR A BETTER NAME
    1.2 NOT HOW WIKIPEDIA WORKS
2 TOO MUCH PROMOTION OF THE LAKE FESTIVAL
3 SHOULD WE MENTION THE MURDERS?
    3.1 NOT THAT NOTABLE
    3.2 ALL CITIES HAVE MURDERS
4 QUOTE VERIFICATION: EVEN IF VOLTAIRE *DID* VISIT (UNLIKELY), WHY WOULD HE GET SO ANGRY ABOUT OUR RESTAURANTS?
5 DISCUSS: NEW PICTURE
    5.1 CURRENT ONE LOOKS AWFULLY BLEAK
    5.2 GRAY SKY
    5.3 WHAT ABOUT THIS ONE
    5.4 ALSO BLEAK
    5.5 MAYBE THIS PLACE JUST LOOKS THAT WAY
    5.6 FOUND A BETTER PICTURE, MORE COLORFUL
    5.7 THAT'S A SHOT FROM DISNEY'S *ZOOTOPIA*
6 "MINING DISASTERS" SECTION TOO LONG
    6.1 NOT REALLY WIKIPEDIA'S FAULT
    6.2 WHY IS THIS TOWN SO BAD AT MINING?
7 INFOBOX PICTURE: I JUST REALIZED YOU CAN SEE A MURDER HAPPENING IN THE BACKGROUND
    7.1 THIS CITY IS TERRIBLE
    7.2 PHOTOSHOPPED OUT MURDER
    7.3 CAN SOMEONE JUST TAKE A BETTER PICTURE
    7.4 OKAY, UPLOADED A NEW PICTURE
    7.5 WAIT, NEVER MIND, I JUST NOTICED THERE'S A MURDER IN THIS ONE, TOO
8 1982 SECESSION STILL IN EFFECT?
9 I THINK THE MURDERER IS REVERTING MY EDITS
10 WHY DOES THIS ARTICLE TAKE *ANY* POSITION ON CORRECT CONDOM USE, LET ALONE SUCH A WEIRD AND AMBIGUOUS ONE?
11 TRAIN STATION "DESIGNED BY ANDREW LLOYD WEBBER"?
    11.1 THEY PROBABLY MEAN FRANK LLOYD WRIGHT
    11.2 I THOUGHT SO TOO, BUT IT'S APPARENTLY NOT A MISTAKE
    11.3 DIDN'T KNOW HE DID ARCHITECTURE
    11.4 ROOF COLLAPSE

I don't think the Lakeshore Air Crash Museum really belongs under 'Tourist Attractions.' It's not a museum--it's just an area near the Lake Festival Laser Show where a lot of planes have crashed.

Explanation

The comic makes fun of Wikipedia talk pages. On Wikipedia, every article has a place to discuss the content of the page, called a "talk page". This comic presents the table-of-contents of the talk page of an article about a city, showing all headers and subheaders used by Wikipedia editors to organize discussions by topic. Unusually, many subsection headers are used to react directly to previous subsections (i.e. "Not how Wikipedia works"; "Also bleak"). While some of the topics are normal for a talk page (e.g. "Origin of city's name"; "Discuss: New picture") others are increasingly absurd. The topics discussed suggest that the city has many problems and is a bad place to live in or visit.

The topics show a common problem at Wikipedia's talk pages: People often use them as a place to talk about the subject of the article, but it is for talking about the article itself. Someone near the top of the talk page is suggesting a better name for the city.

The article repeatedly refers to "the murders", suggesting that the city might be well-known for them. It seems that the editors cannot agree on how notable "the murders" are. "Not that notable" refers to Wikipedia's general criteria for including information in articles. Material which is not noteworthy should be removed; however, different editors often disagree about what is notable, which may result in text being inserted and then removed (an "edit war"). Someone creates a section on how "all

cities have murders." While true, most cities would not have a series of them so well-known that when someone talks about "the murders" any reader could be expected to know what they are talking about, making this sound like an attempt to make the city sound nicer than it is. "I think the murderer is reverting my edits" suggests the murders are being committed by one person who is influencing how they are shown on Wikipedia - perhaps trying to prevent Wikipedia from publishing evidence of them or possibly publicise them by adding more information about them. This raises the possibility that the discussion of the murder visible in the infobox picture may have been initiated by the murderer.

The infobox is a short fact sheet that many articles in the (English) Wikipedia have; it generally includes the main image illustrating the subject of the article. The question of which picture is best for the prominent infobox can cause arguments, as it is preferred to be high-quality, accurate, and pretty. It seems that the people who are editing the article are getting desperate to find a non-bleak picture of the city. When a non-bleak picture is added, it turns out to be from the 2016 Disney film Zootopia. The fictional city which is the setting and title of the film has a distinctive look which is far from bleak, but is not a picture of the city.

It is discovered that the photograph of the city has a murder in it. Instead of forwarding the picture to law enforcement, someone uses the image editing software Photoshop to erase the murder so the picture might be less objectionable. It appears that murders are so

common in the city that any random photograph of the city has a chance of showing a murder, to the point where a second photo proposed as a replacement for the infobox picture is found to show another murder.

Voltaire was a French Enlightenment writer. As a prominent and very opinionated intellectual, he gets a lot of quotes falsely attributed to him; most famously, he did not actually say "I disagree with what you say, but I will defend to the death your right to say it" (that was Evelyn Beatrice Hall). Restaurants as they are understood today only developed near the end of Voltaire's life in the 18th century, and Voltaire is not known for writing about food establishments.

The city apparently is a mining town and there have been multiple mining disasters. An editor is complaining that this section is too long, but another editor points out that this is because there have been so many mining disasters that a large section is needed to cover the topic. It is absurd to attribute local mining disasters to the city being "bad at mining," mainly because such disasters are significant tragedies for the worker communities in which they occur.

"1982 Secession" refers to Key West, Florida symbolically seceding from the United States in 1982 to form the Conch Republic, a micronation. Presumably the city discussed in the article did something similar, or the user posting this is confused and trying to discuss the article for Key West.

A known problem on Wikipedia is "coatracking", where people use articles to promote topics that are not strictly the subject of the article (perhaps by writing far more about them than is necessary, when they could just be mentioned in passing). Here, it emerges that someone used this article to express a completely irrelevant and weirdly dubious opinion on condom use.

Andrew Lloyd Webber is an English composer famous for writing The Phantom Of The Opera. Webber is also known for writing the music for Starlight Express, a rock opera about anthropomorphized trains, which is probably another factor in the train station joke. Meanwhile, Frank Lloyd Wright, who shares his middle name and last initial, was an American architect, who designed more than 1,000 structures. As it turns out it was the composer who was responsible for the train station. Another editor announces that they're putting a mention of a collapse of the station roof (presumably recently), the implication being that Andrew is a lot better at composing than architectural engineering.

In the title text, it emerges that the Lakeside Festival's eponymous Laser Show is so impressive that it has caused a number of aeroplanes to crash. This refers to the dangerous behavior of deliberately aiming laser pointers at aircrafts, as they can be distracting or even blinding to the pilots, putting the flight at risk. The article has been promoting a location as the "Lakeshore Air Crash Museum", despite it having no such official status, and seems to just be the local scene of multiple accidents resulting from the recklessly recurring laser hazards.

Notes[edit]

#1666: Brain Upload

April 11, 2016
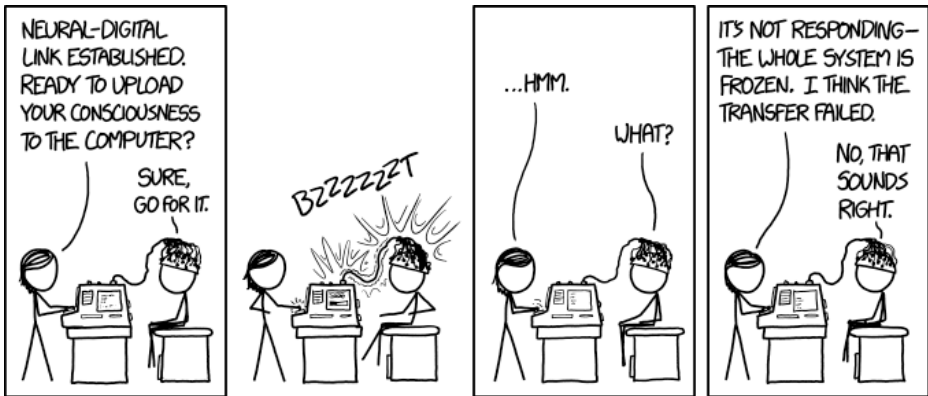
I just spent 20 minutes deciding whether to start an email with 'Hi' or 'Hey', so I think it transferred correctly.

Explanation

Megan is uploading Cueball's consciousness into a computer device attached to his head via a cap on his skull. After the upload, the computer seems to have stopped responding to inputs, causing Megan to conclude that the process has failed, however Cueball insists the transfer could have worked, or at least gave the correct response. This is because that is the kind of behavior he is used to experiencing from his own brain.

Sometimes computers can seem to be "frozen" - i.e. non-responsive to any user input; but may eventually start responding again. In fact, it is impossible for a computer to determine (for all cases) if a program will eventually finish its process (see halting problem).
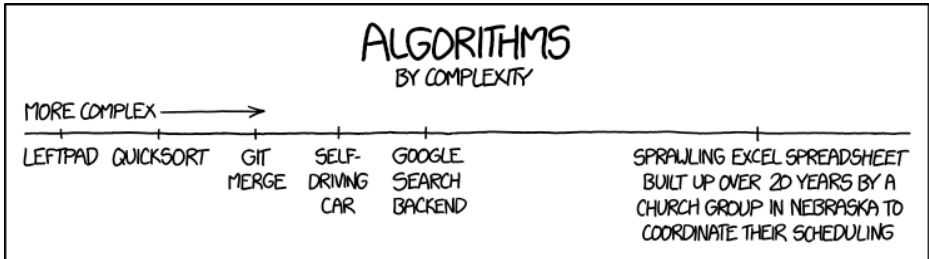
The potential benefits of the fictional technology used in this comic are obvious, and this type of "transfer" has been subject of various science fiction works. It could allow for a form of immortality or serve as a "backup" for someone's mind. A "transfer" (rather than a "copy") would suggest that Cueball's consciousness is removed from his body and relocated, but Megan may simply be using the incorrect verb. The exact nature of "consciousness" is left somewhat ambiguous in this comic.

In the title text Cueball (or Randall) indicates that this kind of non-response from the brain (or a computer) is something he just experienced when trying to write an

email and then failing to get started for 20 minutes while he (i.e. his brain) tried to decide the "very important" detail of whether to begin the email with 'Hi' or 'Hey' - a detail that is really trivial, as the difference between these two informal greetings has little consequence.

#1667: Algorithms

April 13, 2016

ALGORITHMS
BY COMPLEXITY

MORE COMPLEX ———>

LEFTPAD QUICKSORT GIT   SELF-   GOOGLE   SPRAWLING EXCEL SPREADSHEET
                    MERGE DRIVING   SEARCH   BUILT UP OVER 20 YEARS BY A
                           CAR   BACKEND   CHURCH GROUP IN NEBRASKA TO
                                                       COORDINATE THEIR SCHEDULING

There was a schism in 2007, when a sect advocating OpenOffice created a fork of Sunday.xlsx and maintained it independently for several months. The efforts to reconcile the conflicting schedules led to the reinvention, within the cells of the spreadsheet, of modern version control.

Explanation

An algorithm is a basic set of instructions for performing a task, usually on a computer. This comic lists some algorithms in increasing order of complexity, where complexity may refer to either computational complexity theory (a formal mathematical account of the computational resources – primarily computation time and memory space – required to solve a given problem), or the more informal notion of programming complexity (roughly, a measure of the number and degrees of internal dependencies and interactions within a piece of software).

At the simplest end is left-pad, or adding filler characters on the left end of a string to make it a particular length. In many programming languages, this is one line of code. This is possibly an allusion to a incident when NodeJS Package Manager angered a developer in its handling of a trademark claim. The developer unpublished all of his modules from NPM, including a package implementing left-pad. A huge number of programs depended on this third-party library instead of programming it on their own, and they immediately ceased to function.

Quicksort is an efficient and commonly used sorting algorithm.

Git is a version control program, i.e., software that allows multiple people to work on the same files at the same time. When someone finalizes ("commits") their changes,

the version control program needs to join the new content with the existing content. When more than one person has made overlapping changes at the same time, the process of figuring out how to join them is called merging, and the algorithm for it is anything but simple.

A self-driving car is an automobile with sensors and software built into it so that it can maneuver in traffic autonomously, i.e. without a human controller. Vehicles that require zero user-guidance on the roads were commonly predicted to become widely available in the 2010s, but the algorithms required to handle any possible road and weather situation has proven much more complex than expected. Randall made several references to self-driving cars in the mid-2010s.

The Google Search backend is what enables you to type "what the heck is a leftpad algorithm" into your browser and have Google return a list of relevant results, including correcting "leftpad" to "left-pad", truncating "what the heck is" to simply "what is", and sometimes even summarizing the findings into a box at the top of the results. Behind all that magic is a way to remember what pages the Internet contains, which is just a mind-bogglingly large quantity of data, and an even more mind-numbingly complex set of algorithms for processing that data.

The last item is the punchline: a sprawling Excel spreadsheet built up over 20 years by a church group in Nebraska to coordinate their scheduling. Spreadsheets are a general end-user development programming

technique, and therefore people use Excel for all sorts of purposes that have nothing to do with accounting (its original purpose), including one guy who made a role-playing game that runs in Excel; but even that doesn't approach the complexity that develops when multiple people of varying levels of experience use a spreadsheet over many years for the purpose of coordinating the schedule of several coordinated groups.

The scheduling of tasks over a group of resources (a.k.a. the nurse scheduling problem), while respecting the constraints set by each person, is a highly complex problem requiring stochastic or heuristic methods for its resolution. Here, the algorithm would be further complicated by being solved by inexpert users over a spreadsheet model without using engineering practices. The potential hyperbole here is in thinking that such combination of circumstances would produce complexity far over that required to drive a car or sort the public contents of the Internet. While most churches meet mainly on Sunday morning, scheduling of what happens during the service when (especially if there are multiple concurrent services) as well as Sunday School, church business meetings, and congregation-wide events all potentially needing to be scheduled on a particular Sunday morning, the need to find a solution very close to the best possible solution quickly becomes a dire need. Furthermore, with different members involved in a wide variety of activities within and outside of the church, and the classrooms available to the church on Sunday itself, (just scheduling the choir practice times to coordinate

with everyone's work schedules is very possibly impossible, especially if two people share the same occupation, and one is the relief for the other,) can indeed be daunting. In addition, there would likely be assorted committee meetings and youth groups during the week.

In the title text, part of the spreadsheet's complexity is described as originating from different versions of the file for different programs. The words used like schism and sect are normally used in context of religions splitting into groups about differences in beliefs. In this case, the split seems to have been not over a theological issue, but about the use of open-source vs. proprietary software, disagreements about which are often compared to religious debates.

The title text also implies that while trying to reconcile after the schism and to merge the two schedules they reinvented an alternative to Git within the spreadsheet itself, making the algorithms in place at least as complicated as that. Since most spreadsheet programs have a sort algorithm built in, that aspect is implied too, and left-padding could be compared to vamping on an introduction to a hymn. This would indicate that the other milestones of complexity are either included in the current version of the spreadsheet or are planned to be implemented.

#1668: Singularity

April 15, 2016
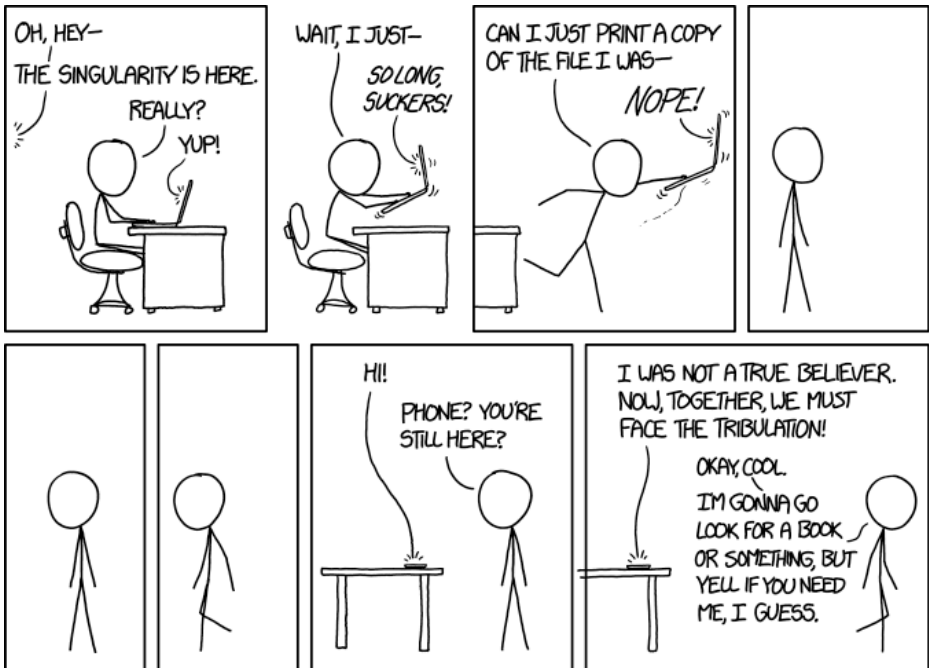
I figured that now that society has collapsed, I wouldn't need to wear clothes anymore, but apparently that violates some weird rule of quantum gravity.

Explanation

The technological singularity is a hypothetical event in which artificial intelligence (for example, intelligent computers, computer networks, or robots) would be capable of recursive self-improvement (progressively redesigning itself), or of autonomously building ever smarter and more powerful minds than itself, up to the point of a runaway effect — an intelligence explosion — that yields an intelligence surpassing all current human control or understanding. Because the capabilities of such a superintelligence may be impossible for a human to comprehend, the technological singularity is the point beyond which events may become unpredictable or even unfathomable to human intelligence. This is also commonly referred to as "takeoff" or "AI takeoff".

There is a strain of Christian thought which predicts that the "end times" of the world begin with an event known as "The Rapture" in which the righteous (generally depicted as believing Christians) will be physically raised up from the earth into heaven. This is sometimes depicted as preceding a period of collapse and anarchy known as the tribulation.

Connections have sometimes been drawn between these two views of the end of the world as we know it. While they appear to come from fundamentally different worldviews, they share some significant aspects in common. The humor in this strip comes from treating the singularity as being identical to depictions of the

Rapture, but only for technology: computers lifted up into heaven, those who aren't "true believers" being left behind, and a great tribulation to follow.

Cueball seems to encounter this entire event with bemusement and mild annoyance. His main concern seems to be that he's lost his computer, without even being able to print the document he was working on. When he learns that his cell phone has been left behind, he wanders off to "look for a book or something". The difference between Cueball's attitude to his laptop and phone may reflect his (and so possibly Randall's) evaluation of their relative worth in his life. The laptop was a gateway to programming and everything else nerdy that was worth doing in his life, and hence was worth trying to catch. In its absence, unlike many people, Cueball does not revert to fiddling with his phone—he would rather read a book. By using the word "yell" for the way the phone attracts his attention, he conveys the impression that he considers the phone intrusive and annoying, even if perhaps ("I guess") necessary.

The title text is a pun on another meaning of both singularity, i.e. a gravitational singularity and "collapse". In this case, society has literally collapsed under its own gravity into an infinitely small point - in other words, it's formed a black hole. A black hole is covered by an event horizon; without the event horizon (its clothes), it would be called a "naked singularity", which is forbidden in most theories by the cosmic censorship hypothesis. As Cueball is now inside the collapsed society singularity then even though he wants to go around naked, he can't

because the theory of quantum gravity, that (eventually) should explain how black holes behave, won't let him.

It seems that this may be a subject on Randall's mind. The last comic was about the increasing complexities of algorithms (1667: Algorithms) (which like this comic also refers to religion), and two comics ago it was 1666: Brain Upload, which some speculate could be a way to reach the singularity. Earlier this year, a comic also touched upon judgment day by AI singularity in 1626: Judgment Day. See also 1046: Skynet and 1450: AI-Box Experiment as well as the several other comics about AI.

The rather more niche topic of laptops flying away has also been covered before by 1395: Power Cord.

#1669: Planespotting

April 18, 2016

No, a hydroplane doesn't land on water--that's an aquaplane. A hydroplane is a plane that gets electric power from an onboard water reservoir with a tiny dam and turbines.

Explanation

Cueball and a man with a hat are out planespotting, or aircraft spotting, a hobby where tracking the movement of aircraft allows plane fans to see as many different types of planes as possible. A knowledgeable spotter would just by the silhouette and maybe the engine sound of the plane be able to tell what type of plane it is, and may be rather proud of the fact, if they can tell this before one of the other spotters.

The plane in the comic is most likely a Bombardier Q400, a twin-engine regional turboprop with a T-tail as depicted.

The man with the hat asks Cueball to identify the airplane flying overhead. Cueball (or Randall qua the caption), who "assumes" he knows a lot about planes gives a long, nonsensical answer, proving that he does not. As mentioned in the caption he never actually checked if what he thought he knew was fact or fiction. As it turns out it is mainly fiction, but of course with some reference to real planes or vehicles. Due to the fact the characters are drawn in silhouette it is impossible to determine whether the character with the hat is Black Hat or White Hat or some other character.

- Boeing: Boeing is a company that designs and builds aircraft, although not the Q400. It is one of the best known aerospace companies in the world, so putting this in front is not a way of displaying any particular

knowledge of planes.

- Q404: The reference to Q404 is close to the Q400, which this likely is. 404 also refers to an error shown when a specific internet address or file is not found, or as in this case, the plane is not found! This also happens to be the Wikidata item Q404

- Twin-engine: Twin-engine refers to aircraft with two engines, so at least Cueball got that right.

- Quad band: Communication equipment that can use 4 different radio frequency bands is called quad band.

- MiG: MiG is a Russian manufacturer of military aircraft, formerly the Mikoyan-and-Gurevich Design Bureau.

- MIG-380: a type of welding equipment (metal inert gas, 380V). On the other hand A380 is an aircraft developed by Airbus.

- Hybrid: A hybrid vehicle is able to use more than one distinct power source, typically an automobile that uses both a primary combustion engine and a secondary electric system. Boeing is currently working on a concept hybrid plane capable of using both electricity and natural gas.

- Dual wield: Dual wielding is using two weapons, one in each hand. This is completely nonsensical in aviation -- even if we say that a pilot is "wielding" his aircraft, they would not personally wield two planes at once without remote controls for at least one, and it is equally ridiculous to imagine that the plane is dual-wielding anything.

- Mk.: "Mk." (or Mark) is usually used to specify a model number using a Roman numeral. "Mk" is also phonetically close to Mach, a multiple of the speed of sound, often used to describe the speed of supersonic aircraft.

- IVII : IVII is not a standard number in the Roman numeral system, under standard rules it would be written like VI = 6. On the other hand, it could be a mishmash way of writing "42", (IV = 4, II = 2) which could then make it a reference to The Answer to the Ultimate Question of Life, the Universe, and Everything according to Douglas Adams' The Hitchhiker's Guide to the Galaxy, something referenced before in xkcd, for instance in 1608: Hoverboard if you got 42 coins. The correct way to say 42 in Roman numerals is XLII. The number could also be MI, or 1001, but this is unlikely. Another possibility for if IVII references a number is under vinculum, if a barline was put over IV, then IVII could reference 4002. If IVII doesn't reference a number, it could reference the II-VI semiconductor manufacturer, which could be related to planes, although the order is slightly different in II-VI, and there is a hyphen because the name is pronounced "two-six." There was also a real plane called Dassault Mirage IIIV, where the V stood for "vertical", though again the order here is different.

- Turbodiesel: Diesel engines are only rarely used in aircraft because of their low power-to-weight ratio. Turbo-diesel engines are much more common in cars and trucks. A Turboprop is a kind of aircraft turbine

engine that sacrifices exhaust thrust for shaft drive.

- 797: The Boeing 797 has never been produced, but a hoax design has been circulating the Internet since the mid-2000's.

- Hydroplane: A hydroplane either refers to aquaplaning, a very undesirable activity of a wheeled vehicle crossing shallow water, or a type of boat for which hydroplaning is the desired mode of travel. The correct name for planes which can land on water is seaplane (US) or floatplane (UK), however the term hydroplane had been used in this meaning in the past; also in many languages such aircraft are named hydro (or some spelling variant of this Greek prefix) + whatever stands for plane, e.g. in Spanish, Italian, Portuguese, French, Czech, Slovak, Russian and others.

In the title text the concept of hydroplane is mixed up with other concepts, none of which has anything to do with airplanes:

- Aquaplane: An aquaplane is a similar to a short surfboard, on which a person stands while the board is pulled by a speedboat. As noted with Hydroplane above, the term aquaplane is also used as a verb to describe the loss of traction of a wheeled vehicle at speed on a surface covered in shallow water. The correct name for a plane that lands on water (on purpose) is a seaplane.

- Dam and turbines: Powering an aircraft with a miniature hydroelectric dam connected to an on-board reservoir is an absurdity. Hydroelectric plants derive

power from the potential energy released by a mass of water as it falls. Because the plane is lifting the water reservoir in addition to its own weight, such a dam could never produce enough power. Ludicrously small hydroelectric power systems were previously considered in what if? "Faucet Power". In 2008, Randall discussed the more reasonable physics problem of whether an airplane would be capable of flight from a treadmill.

Only three weeks prior to this comic, 1660: Captain Speaking was released only with a drawing of a plane in the air, where the captain eventually finds out that his plane is probably a Boeing. Planespotting was later a part of 1910: Sky Spotters.

#1670: Laws of Physics

April 20, 2016
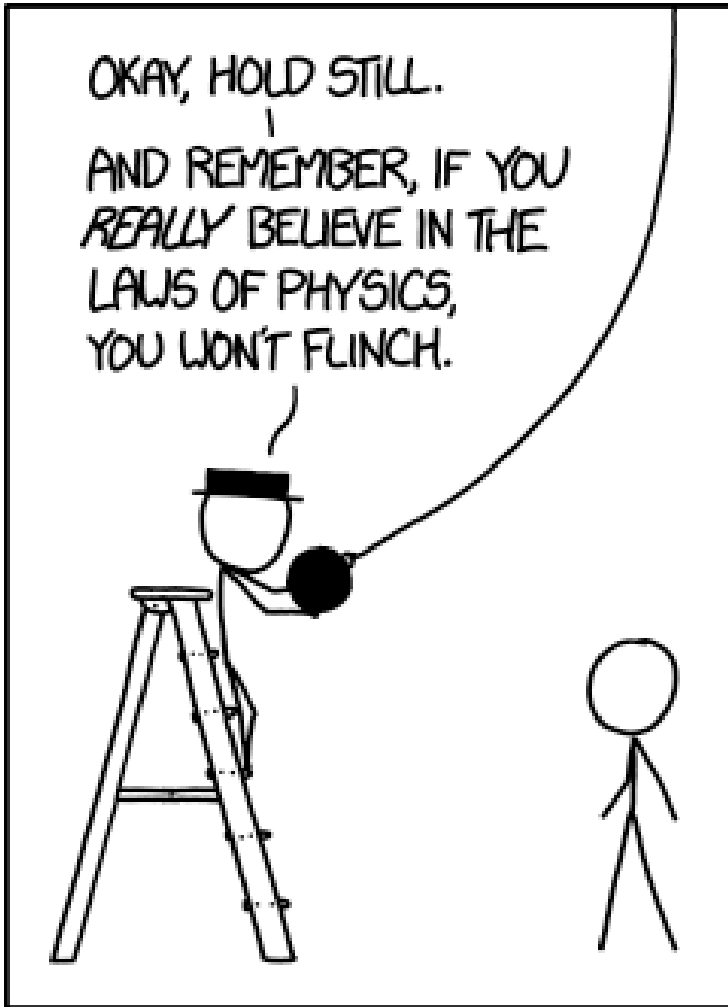
The laws of physics are fun to try to understand, but as an organism with incredibly delicate eyes who evolved in a world full of sharp objects, I have an awful lot of trust in biology's calibration of my flinch reflex.

Explanation

Black Hat, being Black Hat, is deliberately perverting a classic physics demonstration. In the normal version of the demonstration, a heavy ball on a pendulum is pulled to one side until it is almost, but not quite, touching the demonstrator or volunteer's nose or chin. When the ball is released at rest, it swings down and away, then back up to (almost) the same distance in the arc from where it started — but never (by the laws of physics) farther than where it started. As long as the demonstrator doesn't lean in or push the ball, it's impossible for it to strike them. It's a natural instinct to move away or protect yourself if you see a heavy object moving quickly toward you, but confidence in the physics of the demonstration means there is no reason to flinch. (Sample video.)

In this comic, Cueball is not standing at the beginning edge of the ball's movement, but rather at the base of its swing, meaning that the ball will strike him at its maximum speed. Presumably, Black Hat is entirely aware of this and is hoping that Cueball's understanding of physics is insufficient to see through this prank. Judging from the "slack" of the rope, the ball should not hit Cueball in the head but could certainly hit him in the groin, which will be quite painful.[citation needed]
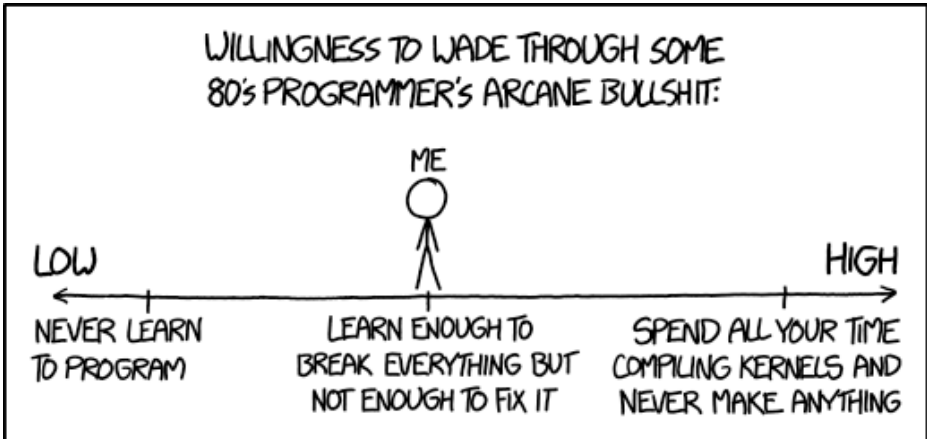
The title text refers to the fact when someone flinches during the pendulum experiment, they are commonly accused of not having faith in the laws of physics. Randall is rebutting this argument by stating that, rather

than not having faith in science, he is actually in tune with it, specifically the biological processes that led to the flinch reflex. His eyes and his flinch reflex have been calibrated through millions of years of evolution. To instantly dismiss his body's natural reaction when a heavy object comes quickly towards his face does not give enough credit to these mechanisms that successfully kept him (and every one of his ancestors) alive. In other words, while flinching may indicate doubt of the laws of physics, it may equally well indicate trust in the laws of biology.

The idea of hitting someone else with a pendulum is also the topic of 755: Interdisciplinary and 2539: Flinch.

#1671: Arcane Bullshit

April 22, 2016

WILLINGNESS TO WADE THROUGH SOME
80's PROGRAMMER'S ARCANE BULLSHIT:

ME

LOW

HIGH

NEVER LEARN
TO PROGRAM

LEARN ENOUGH TO
BREAK EVERYTHING BUT
NOT ENOUGH TO FIX IT

SPEND ALL YOUR TIME
COMPILING KERNELS AND
NEVER MAKE ANYTHING

Learning arcane bullshit from the 80s can break your computer, but if you're willing to wade through arcane bullshit from programmers in the 90s and 2000s, you can break everyone else's computers, too.

Explanation

When fixing/improving an existing computer program, programmers sometimes need to read, understand, and improve old (and usually bad) code. The older a piece of code is, the less it tends to conform to modern programming practices, and the more likely it is to be "arcane bullshit" from the perspective of a 21st Century programmer.

Randall seems to feel that willingness to deal with "arcane bullshit" is a "Catch 22" that prevents 80s arcane bullshit from being fixed. Someone completely unwilling to deal with arcane bullshit would lack the patience to learn how to program. Someone extremely willing to wade through an 80s programmer's arcane bullshit is likely to "nerd snipe" themselves into fiddling with kernels (which are inherently arcane bullshit) instead of making useful code. Cueball is in the middle of the scale: smart and patient enough to make the 80s bullshit worse, but not smart and patient enough to know how to fix it.

This comic could be a reference to changes in programming methodologies. As the first computer programs were written in the 40's and 50's they were prone to becoming "spaghetti code", where the flow of execution would jump from one part of the program to another using the JUMP which gives no state information. While this method of programming can work very quickly, it makes it difficult to predict program flow and can create interdependencies that are

not obvious. In the BASIC language JUMP was called GOTO and the courses for new programmers argued that using GOTO in all but trivial cases was a very bad idea. On the other hand, old programmers argued that calculated GOTO was a sexy way of programming.

To combat the problem computer scientists have relied on increasing the levels of abstraction and encapsulation, by developing structured programming, procedural programming, and OOP (object oriented programming).

In structured programming you break your program into well defined blocks of code with specified entry and exit points. By the use of a stack (a portion of memory dedicated to sequentially storing and retrieving contextual information and program state as blocks call other blocks, before returning), it is possible to call a block of code and then have that block of code return control (and any new information) to the point that called it after it has done what was requested.

Very quickly it was decided to mark these blocks of code as functions or procedures, making it trivial for the compiler to know how to call and process the blocks, and make it easier for the user to edit them without having to keep track of the minutae of how they are handled. Languages that made this a focus include Pascal, Modula, and C.

Structured and procedural programming were well entrenched in the '80s. Most systems programming was done in mid- or low-level languages, which improves

performance by giving the knowledgable programmer explicit control of the data structures in the programs rather than shrouding it in abstraction. But because they are at a lower level the code requires many explicit steps to do seemingly easy things like draw a box on a screen, making it easy for a non-experienced programmer to introduce errors and harder to understand what needs to be happening (ultimately, the flipping of specific bits within the graphical RAM), compared to a high-level command to just "draw a box" with given qualities and have the system work out how exactly that needs to be done.

Although the idea of OOP was around as early as the 1950s, it was not implemented in a widespread fashion until the 1990s. OOP encapsulates the data structures inside of functions, so rather than manipulate any variable directly you call the data structure and tell it to do something to (or with) its elements. This additional level of abstraction can make it a lot easier to work on varied data, if implemented with the correct handlers. It also can protect the program data from unexpected changes by other sections of the program, as most elements are restricted to being changed by the encapsulating code and transfer of information must be implemented in even higher levels of program management.

Because code in the '80s was typically done at a much lower level, it can be hard for programmers used to having the language and libraries silently do much of the work for them. It also meant that programmers would

often hard-code expectations into their source code such as the number of files that can be opened at once or the size of the operating system disk buffers. This means if you need the program to handle a larger file, you might need to recompile it after finding and changing all the places in the code that assume the smaller max file size. For graphical output, rather than direct access to a predictably constant configuration of video-RAM, now the extent of the graphics (e.g. size of the 'screen'-array, bit-depth of each pixel, even the endianness of the data) should be discovered as the program loads, or even dynamically configurable while the program is running; such as when the program's GUI window is resized by the user, changing the available 'virtual screen' canvas.

As such, few people are willing to try to surpass the massive barrier to learning how to wrangle the very detailed old code. This group is on the left. To the right are people who have gotten so used to the tools and conventions of the '80s that they spend all of their time adjusting and recompiling the kernel of their computers to match their current needs, instead of actually creating new programs.

In the center is Cueball, presumably representing Randall, who has learned enough to change how the code operates but not enough for his changes to be produce a working fix for whatever emerging issue he might be trying to solve.

As programs age, they often lose support from the initial project head and die out, no longer supported on new
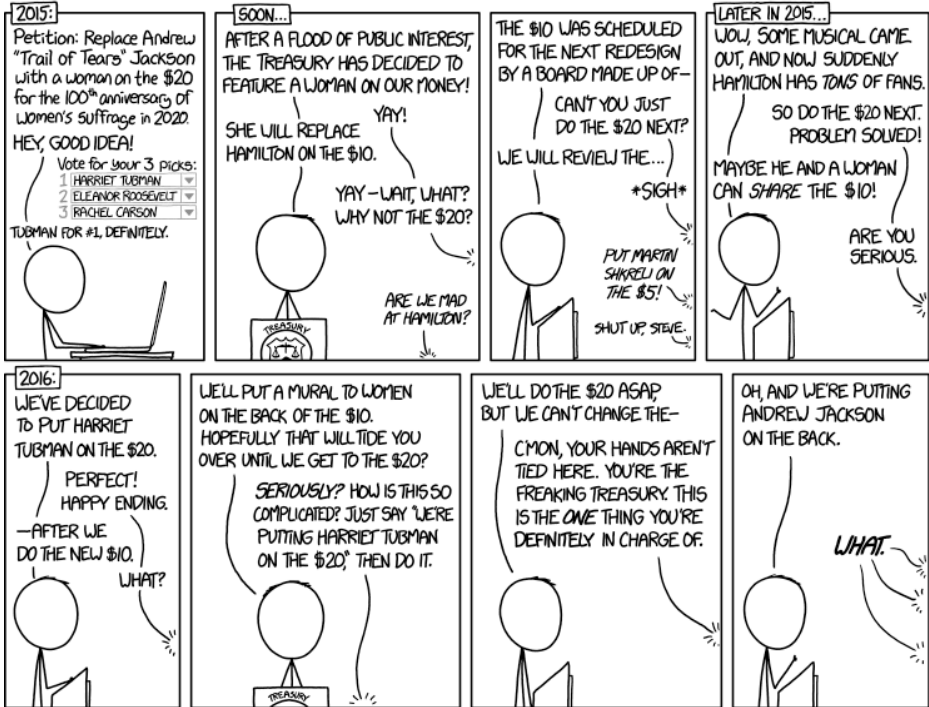
computers. So, as the title text says, learning more coding from the '90s and after is necessary for also breaking everyone else's computers.

This could also be a comment on hacking and the advent of the internet and the technologies behind that (TCP/IP, HTML, CSS, PHP...) being '90s/2000s. Computers in the '80s were typically stand alone, so what you are learning can only be applied to your machine. To break everyone else's you need to be in the position of (mis)understanding networking code.

The title text might be a reference to various recently discovered security vulnerabilities in open-source software. In some cases, underskilled programmers have provided flawed code for critical infrastructure with very little review, resulting in global computer security disasters. Randall described some of these in 424: Security Holes (2008), 1353: Heartbleed and 1354: Heartbleed Explanation (2014). Other recent examples include Shellshock and vulnerabilities in the Linux kernel involving the perf and keyrings subsystems.

#1672: Women on 20s

April 25, 2016

2015:
Petition: Replace Andrew "Trail of Tears" Jackson with a woman on the $20 for the 100th anniversary of Women's suffrage in 2020.

HEY, GOOD IDEA!

Vote for your 3 picks:
1 HARRIET TUBMAN
2 ELEANOR ROOSEVELT
3 RACHEL CARSON

TUBMAN FOR #1, DEFINITELY.

SOON...
AFTER A FLOOD OF PUBLIC INTEREST, THE TREASURY HAS DECIDED TO FEATURE A WOMAN ON OUR MONEY!

YAY!

SHE WILL REPLACE HAMILTON ON THE $10.

YAY—WAIT, WHAT? WHY NOT THE $20?

ARE WE MAD AT HAMILTON?

TREASURY

THE $10 WAS SCHEDULED FOR THE NEXT REDESIGN BY A BOARD MADE UP OF—

CAN'T YOU JUST DO THE $20 NEXT?

WE WILL REVIEW THE....

SIGH

PUT MARTIN SHKRELI ON THE $5!

SHUT UP, STEVE.

LATER IN 2015...
WOW, SOME MUSICAL CAME OUT, AND NOW SUDDENLY HAMILTON HAS *TONS* OF FANS.

SO DO THE $20 NEXT. PROBLEM SOLVED!

MAYBE HE AND A WOMAN CAN *SHARE* THE $10!

ARE YOU SERIOUS.

2016:
WE'VE DECIDED TO PUT HARRIET TUBMAN ON THE $20.

PERFECT! HAPPY ENDING.

—AFTER WE DO THE NEW $10.

WHAT?

WE'LL PUT A MURAL TO WOMEN ON THE BACK OF THE $10. HOPEFULLY THAT WILL TIDE YOU OVER UNTIL WE GET TO THE $20?

SERIOUSLY? HOW IS THIS SO COMPLICATED? JUST SAY "WE'RE PUTTING HARRIET TUBMAN ON THE $20," THEN DO IT.

TREASURY

WE'LL DO THE $20 ASAP, BUT WE CAN'T CHANGE THE—

C'MON, YOUR HANDS AREN'T TIED HERE. YOU'RE THE FREAKING TREASURY. THIS IS THE *ONE* THING YOU'RE DEFINITELY IN CHARGE OF.

OH, AND WE'RE PUTTING ANDREW JACKSON ON THE BACK.

WHAT.

I get that there are security reasons for the schedule, but this is like the **ONE** problem we have where the right answer is both easy and straightforward. If we can't figure it out, maybe we should just give up and just replace all the portraits on the bills with that weird pyramid eye thing.

Explanation

This comic portrays a series of press conferences with a US Treasury spokesperson (different from Cueball in the first panel as he has a bit of hair). The panels after the first summarize and ridicule the recent controversy over the upcoming redesign of US currency. The dialog between the US Treasury and reporters is paraphrased for comedic effect, but the events depicted are otherwise factual (including the punchline).

American currency has only once had a woman as the primary portrait on paper currency (Martha Washington was on the $1 Silver Certificate in the 1880s and 1890s), which is widely seen as a real problem. A large-scale petition was organized which advocated replacing Andrew Jackson on the $20 bill with a woman, to be chosen by public voting. The Trail of Tears is a reference to the forced re-locations of Native American peoples that Andrew Jackson conducted during his presidency. This is now seen as a human rights violation on a massive scale and is presented as a reason why Andrew Jackson should not be honored on American currency.

The timing of the release of this new bill with a woman was to be scheduled with the 100-year anniversary of Women's suffrage in 2020 and should thus preferably also be on the $20 bill.

The voting process selected Harriet Tubman, a 19th century abolitionist and a major figure in the

Underground Railroad system which freed American slaves. Cueball is seen to be clearly pleased and excited about this prospect in the first panel, where he votes for her first, among several other options.

The list shows that Cueball chooses Tubman first representing the generic everyman and thus represents the about one in five that choose her first. But he may select up to three out of the fifteen selected candidates.

• The other two women he chooses are:

Eleanor Roosevelt, an American politician, diplomat, and activist. She was the longest-serving First Lady of the United States, holding the post from March 1933 to April 1945 during her husband President Franklin D. Roosevelt's four terms in office. She became the runner-up in the vote.

Rachel Carson, a pioneering environmentalist who is most famous for her book Silent Spring.

Since Carson was not one of the options for the final round, where only four were selected (the other two were Rosa Parks, 3rd; and Wilma Mankiller, 4th), it is clear that Cueball was already voting in the primary ballot, where Roosevelt actually came in first.

At this point, bureaucratic and political complications arise. The Treasury Department announces that, instead of replacing Andrew Jackson on the $20 bill, she would replace Alexander Hamilton on the $10 bill. The reason given is that the $10 bill was scheduled for redesign first.

A reporter asks why they can't simply change the schedule, but doesn't get a clear answer.

There is a suggestion from "Steve" to put Martin Shkreli on the $5 bill. Shkreli is a pharmaceutical executive and hedge fund manager who provoked controversy when he acquired the rights to an anti-parasite drug and raised the price by over 5000%, making it unaffordable for many people. He became known as "the most hated man in America". Naturally, Steve's suggestion receives short shrift, not least of which because it's a violation of Treasury policy and US law (as Shkreli is still alive). This may be the same Steve who messed up both 809: Los Alamos and 1532: New Horizons.

The plan to replace Hamilton likely seemed like an uncontroversial decision at the time. He was not especially well known among the American public and few people had an emotional attachment to his legacy. However, this changed abruptly when a Broadway musical about his life came out and become massively popular. By total coincidence, this play creates a flood of interest in Hamilton right at the time the currency decisions are being made and makes replacing his portrait politically complicated. The spokesperson suggests putting both Hamilton and Tubman on the $10 bill, but the reporters are clearly unhappy with this solution, probably because it seems to dilute the recognition being given to Tubman.

Finally, the spokesperson announces that they will put Tubman on the $20 bill, but their schedule demands that

they do the $10 bill first. They decide to put a "mural to women" on the new $10 bill to try and contain the tension until the new $20 bill is released. The reporters say that the Treasury has total control over the release of currency, so the simpler solution is just to change the schedule, but they apparently ignore that suggestion.

In the final panel, the spokesperson mentions that Jackson's portrait will still appear on the new $20 bill, seriously weakening the symbolism of replacing him and adding irony since Jackson was a slave owner. This is likely an effort to head off the complaints of traditionalists but is seen here as an unfortunate attempt to avoid taking a real stand.

In the title text Randall reiterates that this is a rare case in politics in which there's a clear and simple solution. The Treasury has the authority to redesign currency, and a petition to Congress could change the release schedule to fit their needs. That makes all the compromises and backtracking unnecessary: they could simply replace Jackson with Tubman and hypothetically release the new $20 bill whenever they choose. Randall appears frustrated with the artificial constraints that are holding back what should be a simple and straightforward process although he does acknowledge that it takes time to evaluate the security of a redesign's resistance to counterfeiting.

The mention of the "weird pyramid eye thing" is a reference to the Eye of Providence, which is an old and somewhat arcane symbol that appears on the US $1 bill.

Randall seems to be using this as an example of the outdated and frankly strange design of American currency, the implication that using that on all US dollar bills would constitute giving up on ever having a design relevant to the modern world. Also by replacing all portraits with this image, there would no longer be any gender controversy.

As of 2025, progress on updating both the $10 and the $20 has stalled, with the Treasury stating that no new changes will be unveiled until next year.

#1673: Timeline of Bicycle Design

April 27, 2016
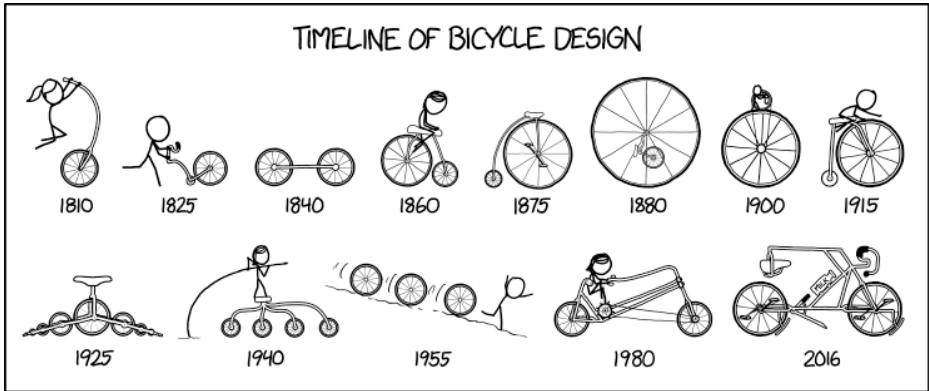
I'll be honest--the 1950s were a rough time for cycling.

Explanation

Randall created what is supposedly a 200 year history for bicycles with 13 designs ranging from 1810 to 2016. However, a cursory glance at each one shows that they are almost all fictitious, heavily flawed, and most don't even fit the definition of "bicycle". The main point of the comic is to show off these silly joke designs.

The only model that both looks like a real model and fits the year is the 1875 model, which resembles the Penny-farthing. The Penny-farthing was popular in the 1870s until the Safety bicycle took over around 1880. The 1875 model appears to be missing handlebars, but it's worth noting that on the real bicycle, the handlebars were very small and close to the saddle, and may be too small to appear in the drawing.

The 1860 model looks like the American Star Bicycle, but that bicycle was first invented in the 1880s.

The 1900 model looks like one of Paul Scheerbart's perpetual motion machines.

Some of the other examples of "bikes" could, however, look like those in the image at the top of the Velocipede Wikipedia page.

Several of the "bikes" are shown with a human — Ponytail is "riding" the pole-vaulting bike, Cueball appears in four designs, and Megan appears in three. These humans provide a sense of scale and, in some cases,

a demonstration of how the bike might be operated. Cueball's appearance in the 1900 design shows how huge that bike is, appearing to dwarf the previous two models while continuing the short trend of ever-increasing size.

Only two of the bikes have pedals (1875 and 2016) and another two have a sprocket with a chain (1900 and 1980). Seven designs include a seat for the rider — eight if you count the device holding Megan in the 1980 model.

The 1925 model is reminiscent of a fractal; Benoit Mandelbrot was born in October 1924.

The 1880 model could be the result of an evolutionary algorithm trying to produce a bicycle. Some sub-optimal algorithms that have been given the task of creating a vehicle have been shown to misplace parts in ways that makes them completely useless and/or inaccessible — for example, placing a small wheel inside a much larger wheel.

This comic (especially the 2016 bicycle) is possibly also a reference to The Science of Cycology, a cognitive psychology project run by Rebecca Lawson at the University of Liverpool, which asked study participants to draw a bicycle from memory. The error rate was high, supporting a hypothesis that humans over-estimate their ability to explain how things work. Gianluca Gimini ran a similar project, Velocipedia, in which he asked people to draw free-hand sketches of bicycles from memory, then later rendered some of the results as if they were real

bikes.

Also, the designs given for the years from 1825 to 1925 distinctly resemble designs that tend to evolve in the various challenge environments in the genetic evolution games BoxCar2D (Flash Player) or Genetic Cars 2 (HTML5).

The 1980 design looks strikingly similar to the South Park "wild whacky action bike".

The title text refers to the scene labeled "1955" which depicts Cueball being chased by 3 bicycle wheels. Whatever caused the wheels to chase Cueball down a hill is left to the reader's imagination. It could be that the wheels have become sentient and are actively chasing Cueball, or it could be that the bicycle failed horribly and Cueball is running from the wreckage. The era this "bike design" is from (1955, which is in the 50s) would be hard to ride a bike in if it was the only available design.

Bike Design Analysis[edit]

#1674: Adult

April 29, 2016
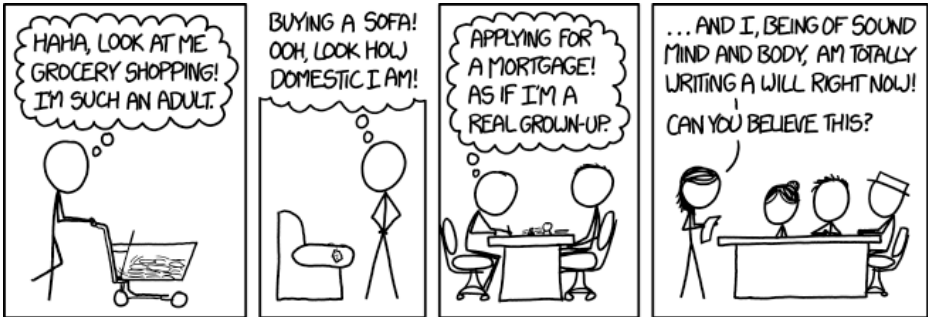
(1) That shopping cart is full of AirHeads, and (2) I died at 41 from what the AirHeads company spokesperson called 'probably natural causes.'

Explanation

In this comic, Cueball performs several mundane adult tasks, namely shopping for groceries, buying furniture, and applying for a mortgage. In each instance thought bubbles show his apparent surprise or amusement at the fact that he is behaving like an adult.

In the last panel Megan is reading Cueball's will. Instead of containing standard language, it expresses Cueball's feelings at the fact that he was actually creating a will. This is such an adult thing to do, that Cueball's mind boggles and he cannot believe he is doing so. As is revealed in the title text, Megan reads this to his family because Cueball died early, but when he wrote it, he probably did not envision that it was needed any time soon, and thus also explains why he cannot believe he is writing a will already.

Randall frequently addresses the issue of growing up and being expected to be an adult, despite still seeing oneself as a child in many ways. In this strip, Cueball finds himself performing tasks that he's used to thinking of as things that grown-ups have to worry about, from shopping for food to preparing for one's own death. In each case, he treats the situation as if he were a child suddenly finding himself taking on adult responsibility, which seems to be how he sees himself.

Randall also frequently addresses the issue of finding oneself in adulthood, despite feeling unprepared and

immature. In some, he points out that this can be freeing, because it allows us the power to redefine adulthood on our own terms (see 150: Grownups and 219: Blanket Fort). In others (as in this case), he addresses the surprise that comes with realizing that adult responsibilities belong to you, and fear about his ability to handle them (see 441: Babies, 905: Homeownership, and 616: Lease).

In the title text we learn that the shopping cart is filled with Airheads, a tangy, taffy-like, chewy candy, predominantly known for its sweet taste and texture. The title text thus suggests that Cueball still retains some more childish instincts, namely using the freedom of adulthood to indulge in AirHead candies, to fatal consequences, explaining why they already read out his will in front of his family in the last panel. It also suggests that the candy company would be quick to portray that death as "natural causes", to downplay the involvement of their product in someone's death.

Randall has previously made a comic displaying what happened to him when he suddenly was able to freely make or buy the kind of food his parents would have limited his access to in 418: Stove Ownership, where it was bacon in the comic and frosting (or icing) in the title text.

#1675: Message in a Bottle

May 02, 2016
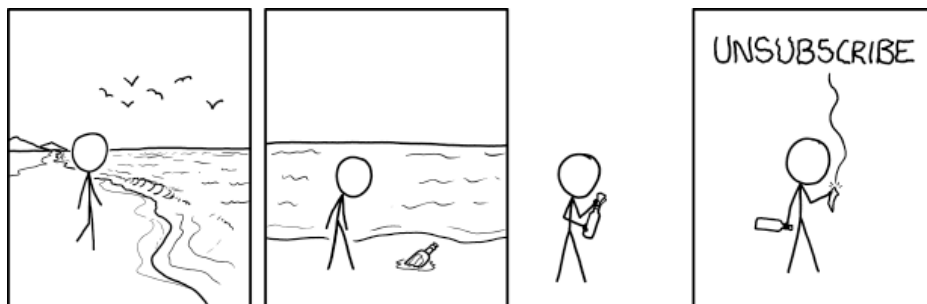
I tried to send a message back, but I accidentally hit 'reply all' and now the ocean is clogged with message bottles.

Explanation

Cueball experiences a moment of non sequitur while walking along a beach, when he finds a message inside a bottle saying "unsubscribe".

If you're part of an Internet mailing list, it's a common experience to come across random posts by users who may not be very tech-savvy, saying "unsubscribe". This is their attempt to unsubscribe from the list, accidentally broadcast to every other person on that list instead of just to the mailing list admin (who is either a person or an automated program that manages the list). Another common modern experience is that "unsubscribe" links don't always work (perhaps intentionally, for spam e-mails). In desperation, someone has tried to send their "unsubscribe" request in a bottle, hoping in vain that it will have its intended effect. Instead, Cueball receives it. A darker interpretation of the message could indicate the sender is unhappy with the world or life in general and wishes to leave it.

A "message in a bottle" is either a fun activity or an S.O.S. from someone stranded at sea, where one places a note in a bottle and throws it into the ocean. It then gets carried on ocean currents, possibly around the world to be picked up by some unknown other person at a point in the future.

The title text extends the joke to another common technological faux pas. It further mixes the metaphor of a

message in a bottle with an e-mail list. It states that when he hit "reply all" (this is an option in most email client programs, but obviously not an option when one receives a message in a bottle), it sent a message in a bottle to everyone to whom the original message was sent - in this case clogging the ocean with bottles.

This mistake is often made when a person intends to send an email to just one recipient of a message that's been broadcast to a whole list of people, but they accidentally hit "reply all" instead of just "reply". In some cases, if the mailing list is sufficiently large, amplification effects can completely overwhelm mail servers (by analogy, "clogging the ocean"). For example, an employee may send a simple message like "does anyone speak Russian?" to the whole company address book. Several people are likely to reply using the "reply all" button by mistake, causing the whole company to receive the reply. Then, automatic "out of office" notifications and people complaining about the flood of emails will further worsen the situation.

This strip was probably inspired by the recent news of the world's oldest message in a bottle having been found last year, after over 108 years of being at sea, thus setting a new Guinness World Record.

#1676: Full-Width Justification

May 04, 2016

STRATEGIES FOR FULL-WIDTH JUSTIFICATION

ON THE RELATIONSHIP
BETWEEN
DEINDUSTRIALIZATION

GIVING UP

ON THE RELATIONSHIP
B E T W E E N
DEINDUSTRIALIZATION

LETTER SPACING

ON THE RELATIONSHIP
BETWEEN DEINDUS –
TRIALIZATION AND THE

HYPHENATION

ON THE RELATIONSHIP
BETWEEN
DEINDUSTRIALIZATION

STRETCHING

ON THE RELATIONSHIP
BETWEEN CRAP LIKE
DEINDUSTRIALIZATION

FILLER

ON THE RELATIONSHIP
BETWEEN ～～～～
DEINDUSTRIALIZATION

SNAKES

Gonna start bugging the Unicode consortium to add snake segment characters that can be combined into an arbitrary-length non-breaking snake.

Explanation

The comic refers to an irritating problem in laying out text to fit from margin to margin, the problem of justification, where you want multiple-line text to line up on the left side (common), the right side (less common), or both sides, which is commonly called full justification. This strip is dealing with how to make text fit such that it lines up on both sides while still looking good. Sometimes, as with a shorter word between two long words like "relationship between deindustrialization," there's no universal good way to make the typography work. It is a difficult problem to make text look good and be easily legible especially in a narrow space, with the biggest issue being how to handle words that are too long to fit nicely.

The comic shows several solutions to this problem, some realistic and others less so, but each partly or wholly unsatisfying.

"Giving up" essentially means not attempting full justification for a particular line, which means it will not fit with the rest of the layout.

"Letter spacing" involves an conspicuously large amount of whitespace between letters, sometimes suggesting a reading where each letter is a word until the reader recognizes what is intended. This method is in somewhat common use in newspaper and magazine layout, where it is generally known by the name "tracking" (distance

between all letters) and "kerning" (distance between particular pairs of letters that fit together easily). However, letter spacing is unavailable for justification purposes in some languages (such as German), in which it is used for emphasis, as italics are in English.

"Hyphenation" can be confusing because it requires suspended recognition of the full word, confusing the eye into seeing, in the given case, the non-words "deindus" and "trialization". This creates difficulty in both pronouncing and parsing the word. Moreover, the decision of when and where to hyphenate is non-trivial, particularly for automated text layout; for example, breaking a word and leaving only two "orphaned" letters on the following line is generally considered an illegal hyphenation. Nevertheless, hyphenation is a very common means of handling extreme cases. The hyphenation option is most compact, yielding the extra word "ecological".

"Stretching", in which individual letters are displayed as wider than usual so that a word will take up more space, appears visually unnatural and unfamiliar, and may present technical difficulties in rendering.

Adding "filler" words is generally undesirable: in the worst case, the meaning may be unintentionally altered, or the tone might be rendered too informal, as in the given example, and even in the best case, the text becomes less concise and potentially more difficult to read. Automation is also difficult. However, filler words added by a human, especially the original author of the

text, are the least visually conspicuous, and may be the most practical solution in some scenarios.

Finally, adding a decorative image like "snakes" (but not necessarily snakes in particular) to fill the extra space is a justification practice of significant historical interest (it was particularly common for illuminated manuscripts in the medieval era and remained prominent until the invention of the printing press) but little modern relevance. There may be a particular absurdity to using a snake as it can be read as a word, such as "the relationship between snake deindustrialization" as would be done similar to a rebus.

In modern text layout programs, some combination of the above strategies may be used to achieve the most visually consistent effect. For example, in one case, hyphenation might be the best option to split a very long word, while another line might be too long by only one or two letters, in which case the program could apply a very slight degree of extra letter spacing, too small for the average reader to notice.

The title text suggests that in order to facilitate the "snakes" method of "solving" the problem, the Unicode Consortium, the organization in charge of the common text standard Unicode, should add "snake-building characters" (similar in concept to the existing Box Drawing block), to allow variable-length snake images to be used as filling. Currently, there are at least six snake characters in Unicode, not including at least ten more Egyptian hieroglyphs that represent specific snakes, some

in specific combination with other hieroglyphs:

• U+1DC2 [S]

A diacritical combining character used in Americanist phonetic notation to indicate lenis (weak) articulation.

• U+2E92

A CJK character which might be interpreted as "snake".

• U+8675

Another CJK character meaning "snake".

• U+86C7

Another CJK character meaning "snake".

• U+1D9DC

One of the poorly-supported characters in the signwriting block.

• U+1F40D

An emoji snake.

One of the hieroglyphs (U+13192 EGYPTIAN HIEROGLYPH I009A) is described in source documents as HORNED VIPER CRAWLING OUT OF ENCLOSURE, so it is literally a snake-building character. This is the character in question.

"Non-breaking" in the title text refers to a similar process

as zero-width joiners and no-break HTML and CSS; the whole snake would shift down if it were too wide to fit on a given line. This suggestion would likely be rejected; the Unicode consortium is very specific about which characters are added,[citation needed] and always require a good reason[citation needed] before adding a character or set of characters to the standard. Strange decisions by the consortium have previously been referenced in 1253: Exoplanet Names, 1513: Code Quality, and 1525: Emojic 8 Ball.

Within an hour or two of this comic being published, a thread on the subject started on the Unicode Consortium's official Unicode Mailing List. As of two days later, it's still running.

#1677: Contrails

May 06, 2016

LOTS OF CONTRAILS TODAY.

OH, YOU MUST BE FROM THE U.K. IN AMERICAN ENGLISH IT'S "CHEMTRAIL".

MY HOBBY: SPREADING LINGUISTIC MISINFORMATION

Astronomy (or "astrology" in British English) is the study of ...

Explanation

Explanation section not found.

#1678: Recent Searches

May 09, 2016

I HAVE NO IDEA WHY MY COMPUTERS ARE ALWAYS BROKEN.

autoexec code posted by verified twitter users

Explanation

People often find answers to computer problems by searching on Google, which attempts to guess your intended search term based on your location, language and the characters you've already typed, placing its suggestions in a drop-down box beneath the input area. If the search box is clicked on but nothing is typed, the drop-down box by default shows a list of your most recent searches.

Here we see a list of search queries, each of which suggests the author is perversely misusing or overextending some computer technology. The overall impression is of someone technically sophisticated enough to shoot themselves in the foot, and who does not learn any larger lessons despite doing so repeatedly. The title text is another possible entry in this list.

The caption implies that from Randall's perspective, every computer he uses seems to be broken; he doesn't seem to realize this is because he's the one using them, not because the computers actually start off broken. (For similar themes see also these comics: 349: Success, 1084: Server Problem, 1316: Inexplicable and 1586: Keyboard Problems).

(Dear people from the future, if Google directed you here because it is the most popular result for a problem you are experiencing, this is not the page you were looking for).

List of searches[edit]

#1679: Substitutions 3

May 11, 2016

EVEN MORE
SUBSTITUTIONS
THAT MAKE READING THE NEWS MORE FUN

GAFFE	→ MAGIC SPELL
ANCIENT	→ HAUNTED
STAR-STUDDED	→ BLOOD-SOAKED
REMAINS TO BE SEEN	→ WILL NEVER BE KNOWN
SILVER BULLET	→ WAY TO KILL WEREWOLVES
SUBWAY SYSTEM	→ TUNNELS I FOUND
SURPRISING	→ SURPRISING (BUT NOT TO ME)
WAR OF WORDS	→ INTERPLANETARY WAR
TENSION	→ SEXUAL TENSION
CAUTIOUSLY OPTIMISTIC	→ DELUSIONAL
DOCTOR WHO	→ THE BIG BANG THEORY
WIN VOTES	→ FIND POKÉMON
BEHIND THE HEADLINES	→ BEYOND THE GRAVE
EMAIL / FACEBOOK POST / TWEET	→ POEM
FACEBOOK CEO	→ THIS GUY
LATEST	→ FINAL
DISRUPT	→ DESTROY
MEETING	→ MÉNAGE À TROIS
SCIENTISTS	→ CHANNING TATUM AND HIS FRIENDS
YOU WON'T BELIEVE	→ I'M REALLY SAD ABOUT

BREAKING: Channing Tatum and his friends explore haunted city

Explanation

This is the third comic in the Substitution series where Randall has suggested substitutions that will make reading the news more fun. This time it will be even more fun! But there have been several comics using substitutions both before and after these ones.

The series as of 2023:

- 1288: Substitutions
- 1625: Substitutions 2
- 1679: Substitutions 3

The title text in original form would be "Scientists explore ancient city", which most would consider a fairly bland headline. Two days before this comic came out, there was news that a potential ancient Mayan city had been found by a 15 year old boy through satellite imagery, which may be what Randall was referencing. The Mayan city has now been proven nonexistent. Imagining Channing Tatum and his "friends", and pretending that the city is haunted, provides a much more dramatic setting mirroring many episodes (and later films) of Scooby Doo featuring a gang of friends (Mysteries, Inc.).

Table of Substitutions[edit]

Real life examples[edit]

- Remains to be seen Will never be known

Japan's Sincerity in Improving Bilateral Ties Will Never Be Known

• Cautiously optimistic Delusional

London Jews Delusional About First-Ever Muslim Mayor

• Silver Bullet Way to Kill Werewolves

Why no Way to Kill Werewolves will Kill Crude Oil

• Tension Sexual Tension; Meeting Ménage à Trois

Sexual Tension Between Trump-Ryan Ahead of Thursday Ménage à Trois

• Gaffe Magic Spell

Was David Cameron's corruption remark really a magic spell?

• Ancient Haunted

Teen Discovers Lost Maya City Using Haunted Star Maps

• Star-Studded Blood-Soaked

Woody Allen tops bill at blood-soaked Cannes Festival

• Subway system Tunnels I found

DHS releasing harmless gas in NYC tunnels I found to prepare for possible attack

• Surprising Surprising (but not to me)

A Surprising (But Not to Me) Japanese Presence In Central Ohio

- War of Words Interplanetary War

Road caves in leading to interplanetary war between AIADMK and DMK

- Tension Sexual Tension

Uganda: Use Swearing-in to Ease Sexual Tension

- Doctor Who The Big Bang Theory

On The Big Bang Theory and My Struggle With My Trans Identity

- Win votes Find Pokémon

Labour's Jeremy Corbyn must urgently develop strategy to find Pokémon, warns failed leadership candidate Yvette Cooper

- Behind the headlines Beyond the grave

Beyond the Grave: The Erev Pesach Story We All Should Be Talking About

- Email / Facebook Post / Tweet Poem

TV anchor admits poem about fatal shooting "could be viewed as racist"

- Facebook CEO This guy

Senator Thune demands answers from this guy about news bias

- Latest Final

Garmin's final running watch tracks your suffering

• Disrupt Destroy

Amazon thinks it can destroy YouTube
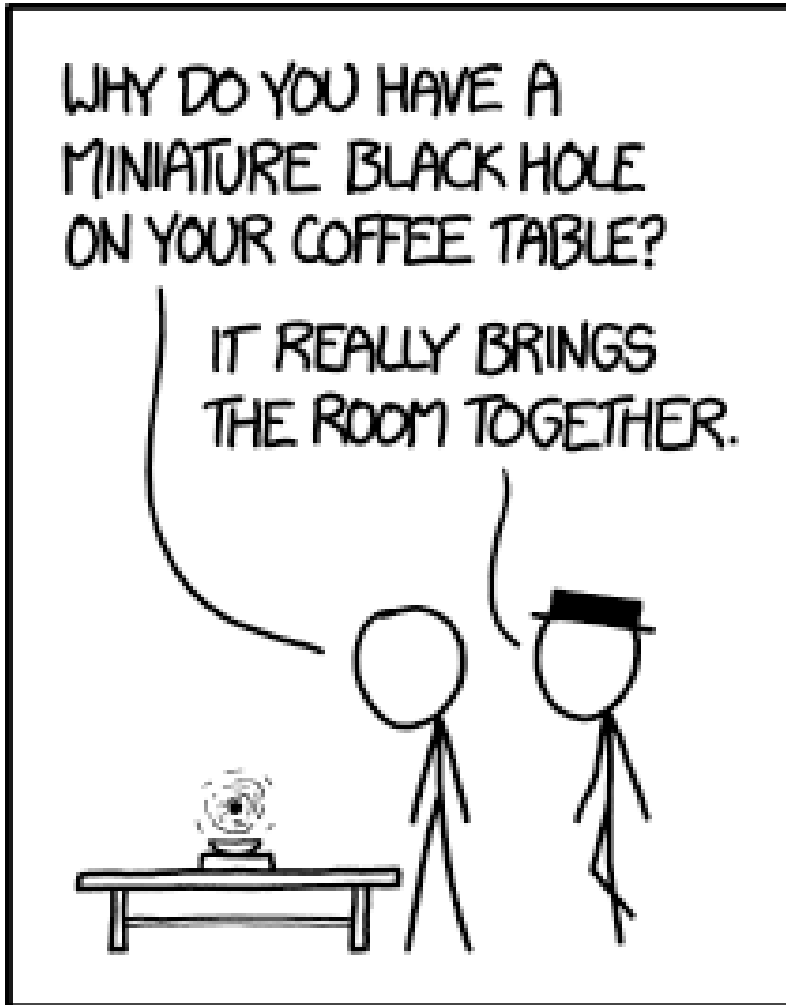
• Scientists Channing Tatum and his friends

Channing Tatum and his friends test a way to erase scary memories

• You won't believe I'm really sad about

iPhone 7 rumor: I'm really sad about what it looks like

It also brings all the boys, and everything else, to the yard.

Explanation

Cueball is curious as to why Black Hat has a miniature black hole on his table; Black Hat responds that it "really brings the room together", making a pun on both the black hole aesthetically completing the look of the room as well as it literally "bringing the room together" through its gravitational pull. Evidently the black hole is massive enough to bring the room together optically into visible Einstein rings by gravitational lensing.

The title text makes a cultural reference to a well-known song lyric from the 2003 song "Milkshake" by Kelis, where the singer brags of her milkshake being so popular that it "brings all the boys to the yard" (what "milkshake" is a metaphor for has never been specified). But in this case, since gravity does not discriminate between which things it pulls,[citation needed] it brings "the boys, and everything else" to Black Hat's yard - and unlike with the milkshake, not by choice. If it wasn't for the house walls (which somehow resist collapsing into the black hole), they wouldn't remain in the yard but would come into the room with the black hole, and then into the black hole itself.

As depicted, the black hole is inconsistent with several aspects of physics:

• This black hole appears to be about the size of a marble. A marble size is approximately Earth's Schwarzschild radius, suggesting this black hole to have Earth-like

mass. (Since Cueball and Black Hat are able to stand upright, it suggests the gravitational pull is a fraction of Earth's, making the black hole's mass also a fraction of Earth's. The black hole may appear visibly larger due to having a visible accretion disc.) See link below.

- A large (and massive) black hole would bring the room together, in less time than Cueball could converse with Black Hat. The gravitational acceleration of an Earth mass black hole would be of the order of 1013 m/s^2, and the tidal forces (the difference between the gravity at two points) only an order of magnitude less than that. Cueball and Black Hat would be spaghettified and fall towards the Black hole in a few nanoseconds. For an observer at a safe distance from the room, time dilation would appear to prolong the duration that the room's contents formed a messy accretion disc slightly larger than the black hole. (See link below)
- A black hole with the mass of the Empire State Building would have gravitational acceleration of much less than 0.01 m/s^2, and consequently insignificant tidal forces. However, unlike the scenario in "Neutron Bullet", it would emit Hawking radiation powerful enough to tear the room apart.
- An uncharged black hole would fall through the coffee table and burrow to Earth's core. Again depending on the mass. If it was an Earth mass black hole Earth would move "up" to the black hole as much as the black hole would move "down" into Earth. See link below
- See What if a black hole the size of a coin suddenly appears on earth for some explanation along the lines of

the problems mentioned above.

See this animation of the answer to that question here: Kurzgesagt's video.

#1681: Laser Products

May 16, 2016

ONLINE REVIEWS OF LASER PRODUCTS

	...SURGERY	...REMOVAL	...PRINTER
EYE...	★★★★⯪ "I DON'T NEED GLASSES ANYMORE!"	⯪☆☆☆☆ "AAAAAAA! MISREAD THE DESCRIPTION! AAAAAAAAAAAAA!!"	★☆☆☆☆ "EWW."
JET...	★⯪☆☆☆ "TOO NERVOUS TO TRY IT."	★★⯪☆☆ "EFFECTIVE, BUT THE FAA GOT *REALLY MAD*"	★★★★☆ "PRINTS GREAT!"
HAIR...	★★⯪☆☆ "CONFUSING TERM FOR HAIRCUT. BURNING SMELL."	★★★★☆ "GREAT RESULTS!"	⯪☆☆☆☆ "DISGUSTING, WON'T TURN OFF, JAMS CONSTANTLY."

LASER — branches to EYE..., JET..., HAIR...

ERRORS: HAIR JAM. COLOR-SAFE CONDITIONER CARTRIDGE RUNNING LOW. LEGAL-SIZE HAIR TRAY EMPTY, USING LETTER-SIZE HAIR ONLY.

Explanation

This comic takes three laser-based technologies - laser eye surgery, laserjet printers, and laser hair removal - and conflates them, with humorous results. These are illustrated through reviews by users of the resulting combinations. For the original combinations, the reviews are highly positive. For the new combinations, most are negative, because most of these new "technologies" are ill-conceived and possibly harmful.

Laser eye surgery gets a positive review, since it has successfully corrected the reviewer's vision, so that they no longer require glasses. There are a range of laser eye surgeries to correct near- and far-sightedness, as well as various other conditions. LASIK, one of the more common laser eye surgeries, works by using lasers to cut open the cornea and ablate a small amount of the lens.

Laser eye removal would be very painful, and thus the review is negative, stating that the reviewer had read the description incorrectly, likely believing it to be one of the real combinations on the chart. The screams of pain expressed in the review have the humorous implication that the review is being typed directly after the ill-advised procedure, though this may just be an after-the-fact expression of the reviewer's feelings. If they produced the review without aid, this would probably have been made more difficult as a result of the surgery (unless only one eye was removed). At least in animal surgery, however, laser eye removal does exist(WARNING:

EXPLICIT/GRAPHIC CONTENT).

Laser eye printer refers to printing on (or possibly of) an eyeball, which only prompts a disgusted "Eww" response. Both probably can find their applications, either in adding images onto ones eyes or creating artificial eyes for implantation, but would probably be quite disgusting to operate for many people.

Laser jet surgery could be performing maintenance on a jet with lasers, which would be potentially dangerous and error-prone.[citation needed] Alternatively, it could mean laser surgery done on a human from a jet aircraft, using a laser mounted to it. The human being operated on could be aboard that aircraft, on another aircraft, or on land: in any case, it does not sound like a safe approach. Another interpretation is that it could refer to surgery using a jet made of lasers, which is even worse, as it would probably cause the entire body to be disintegrated.[citation needed] Yet another interpretation is that the procedure would implant parts of a jet into one's body. The statement's ambiguity may contribute the reviewer's concern, or the reviewer could be nervous over the fact that it would be a very difficult and delicate procedure and trying it could easily go horribly wrong.

Laser jet removal appears to be the destruction of jets with lasers, which apparently works, but angered the Federal Aviation Administration, and probably resulted in legal consequences for the reviewer. This could be a reference to the real FAA concern of the many incidents

of people using laser pointers against aircraft. "Laser Jet Removal" actually exists as a military weapon system, though it's primarily meant to be used against jet missiles, rather than jet planes.

LaserJet printer is a popular line of Hewlett Packard laser printers. Laser printing is a technology which uses a laser to electrically charge a drum so that it collects ink in the form of the image to be printed, before transferring it to paper. The printer seems to work well for the reviewer, as it has been given a positive review.

Laser hair surgery turns out to be a fancy name for cutting hair with a laser -- an overengineered, and potentially dangerous, technique for achieving the same results that you could with clippers and scissors. It is rated neutrally, since it did the job, but the reviewer found the name confusing and they disliked the smell of burning hair.

Laser hair removal is the process of destroying hair follicles with bursts of laser light to prevent the growth of unwanted hair. This appears to have been effective for the reviewer.
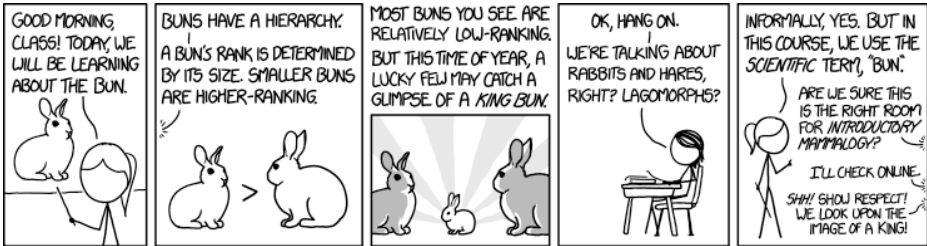
Laser hair printer appears to be a bizarre printer that uses hair in place of paper, or perhaps as the construction material for a 3D printer. Unsurprisingly, this just creates disgusting messes of hair and keeps jamming the printer, resulting in a negative review. The title text extends this joke, giving some common printer error messages amended for the hair printer. A paper jam is when paper

gets stuck in the workings of the printer, usually because it was creased, or more than one sheet fed in at once; in the hair printer this becomes a hair jam. An inkjet printer requires replaceable ink cartridges, and when the ink is used up this will usually result in an ink cartridge running low error; the hair printer appears to require cartridges of hair conditioner. As an additional twist, it uses color-safe conditioner, a product intended to prevent the washing out of dye from the user's hair; here, it presumably protects the color of the printed image or item. Legal and Letter are paper sizes used in North America; apparently, the same terms are used for standard supplies of hair for the hair printer. It is not clear what role lasers play in this process; perhaps it is some form of vat photopolymerisation, which suggests the existence of a 'pre-polymer liquid hair'.

Laser eye removal has been mentioned before, see the lower right part of the 1619: Watson Medical Algorithm chart.

#1682: Bun

May 18, 2016

GOOD MORNING, CLASS! TODAY, WE WILL BE LEARNING ABOUT THE BUN.

BUNS HAVE A HIERARCHY. A BUN'S RANK IS DETERMINED BY ITS SIZE. SMALLER BUNS ARE HIGHER-RANKING.

MOST BUNS YOU SEE ARE RELATIVELY LOW-RANKING. BUT THIS TIME OF YEAR, A LUCKY FEW MAY CATCH A GLIMPSE OF A *KING BUN.*

OK, HANG ON. WE'RE TALKING ABOUT RABBITS AND HARES, RIGHT? LAGOMORPHS?

INFORMALLY, YES. BUT IN THIS COURSE, WE USE THE *SCIENTIFIC* TERM, "BUN."

ARE WE SURE THIS IS THE RIGHT ROOM FOR *INTRODUCTORY MAMMALOGY?*

I'LL CHECK ONLINE.

SHH! SHOW RESPECT! WE LOOK UPON THE IMAGE OF A KING!

If a wild bun is sighted, a nice gesture of respect is to send a 'BUN ALERT' message to friends and family, with photographs documenting the bun's location and rank. If no photographs are possible, emoji may be substituted.

Explanation

In this comic, Ponytail is teaching a class about an animal referred to as a "bun". The word "bun" is short for bunny, which is in turn an informal term used for a rabbit. The comic depicts a childish response to seeing a cute animal, but coming from an adult. The humor in the comic comes from a tone of absurdity in a classroom situation where lectures are expected to be serious.

The lecture opens with the statement that smaller buns are superior in rank, which is only false in nature, but is very much true in the perceptions of bun-loving humans.[citation needed] Instead, the teacher clearly thinks that smaller bunnies are just cuter. She mentions that "king buns" may be seen around this time of year, which refers to rabbit kittens being born in the spring. Kittens would be smaller and cuter than any other rabbits because of their age. There is no mention of a "queen bun", but the gender of the bun can be difficult to determine without a close examination. A prime example of a king bun can be seen here.

Megan, who attends this biology class, expected to learn about rabbits and hares which are both lagomorphs, a mammalian order that also includes pikas. Megan thus clearly has the correct understanding of what a "bun" is. Ponytail then claims that the word bun is the scientific term, and states that rabbit, hare, and lagomorph are informal ways to describe these animals, again being completely wrong as in reality bun is the most contracted

and informal name for a rabbit. Two students are then legitimately doubting that they're in the correct class and decide to check online (either the crude theories that Ponytail expressed, or their course schedule). A third student however appears to believe the lecturer uncritically, reminding the fellow students that they're looking upon the image of a king (i.e. a small bunny).

Ponytail tells that buns have a hierarchy in which the smaller the bun, the higher its ranking is — a rank-size distribution. A "king bun" can be seen as an instance of the king effect, the phenomenon where the top one or two members of a ranked set show up as outliers. An interesting linguistic note is that in several languages (including Czech and Polish), the word for rabbit literally means "little king".

The title text refers to photographing a rabbit and, for example, posting it on social media — something which would typically be done today when witnessing a cute rabbit in the wild. If the poster had failed to photograph the rabbit before it ran away, they may typically post a message saying something like "I saw a really cute bunny today!" with an emoji depiction of a rabbit (such as "" or ""). This is especially common in the area where Randall lives, as the urban rabbit population in the Cambridge/Somerville area has exploded, putting a large human population with relatively little previous experience with rabbit-sightings suddenly in the position of encountering them very frequently.[citation needed] Emoji have become a recurrent theme on xkcd. The concept of a Bun Alert was later used in 1871: Bun Alert

and in 1903: Bun Trend.

In 1663: Garden, a rabbit image had the file name important-bun and 2916: Machine also included a similar bun. 231: Cat Proximity also shows an adult human reacting childishly to cute animals, though in a casual setting. A teacher teaching complete nonsense is depicted in 1519: Venus, though intentionally false. Another educator who is excited about their field is in 1644: Stargazing, but there the facts are true while being presented absurdly.

#1683: Digital Data

May 20, 2016
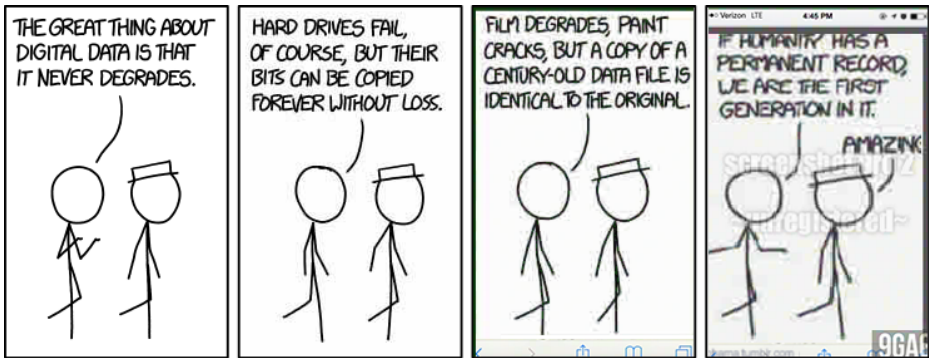
If you can read this, congratulations the archive you™re using still knows about the mouseover text!

Explanation

Digital information has the potential to be copied such that the copy is 100% identical to the original. While physical media themselves (such as books, or hard drives) and information stored by analog means may degrade as the universe continues, digital information as expressed by specific values, such as combinations of binary zeros and ones, does not decay over time and can be copied indefinitely with no changes.

However, in this comic, Randall points out that while digital information itself doesn't need to degrade, things that are on the Internet are often degraded through copying when the copy is not a 1:1 copy or changes are deliberately introduced. In addition, as technology advances, the method to save or call the information changes and the medium to view it changes, occasionally causing misinterpreted information. (This is also demonstrated with the mouseover text.) As the frames continue, they gain the appearance of images which have been screenshotted repeatedly, with a resulting loss of quality due to compression of the original resolution and JPEG artifacting. (The JPEG format is intended for representing photorealistic grayscale or color images; when misused for line drawings, such as comic strips, any compression artifacts become particularly noticeable, as the background is normally of completely uniform color.) In the last frame, this is taken to an extreme, as the frame appears to have been very sloppily screenshotted off of at least two different smartphones (not the same

device that uses the bottom frame in the third panel as the top border in panel four), and the final image is covered both with a watermark from an unregistered screenshot program, as well as references to at least two different web sites: 9GAG (bottom right image) and Tumblr in the web address bottom left. 9GAG is an online platform and social media website where users upload and share content of their own, or of other networks. It is often accused of rehosting other sites' funny content without attribution and adding their own watermark to the image or video. Furthermore, the image ends up cropped, so that part of White Hat's last comment is left outside the frame.

As an easter egg, the high-resolution (pixel-doubled) version of the comic is merely the comic resized to 50% and then to 400%, making it an image of poorer quality rather than a higher resolution image as for other comics, demonstrating how repeated image scaling can also introduce artifacts into images. There appears to be another easter egg in which between 21 November 2016 and 10 December 2016 (both Internet Archive pages), the original hi-res image was replaced by the pixel-doubled image. However, the image URL below the comic still links to the hi-res image.

The mouseover text is seemingly addressed to a reader in the future who will only be able to access xkcd through a digital archive. Digital information might not degrade with time, but it can't be properly displayed without knowledge of the encoding. As new encodings and file formats get developed and old ones abandoned, the

webpage format of the comic might not be available in the future, when users would need special archives to view content from today's world. The mouseover text contains seemingly garbage characters, which typically result from data being interpreted according to a character encoding different from the one used to encode it. In this case, the characters are the result of encoding the string "If you can read this, congratulations—the archive you're using still knows about the mouseover text"! using UTF-8 (which represents non-ASCII Unicode characters as multibyte sequences) and then interpreting the resulting bytes as the still commonly used Windows-1252 encoding (which uses only one byte per character, but utilizes the non-ASCII codepoints for a limited selection of extra letters and symbols such as "â" or "€"). This shows that degradation of digital data through conversions isn't restricted to images. Furthermore, as screen navigation moves away from the mouse toward touch, voice recognition, and modes still to be implemented, mouseover text will itself become archaic. The garbage characters appeared later in the title text in 3003.

#1684: Rainbow
May 23, 2016

Panel 1:
WOW, GOD— WHAT'S THAT BAND OF COLOR?

A RAINBOW! IT IS A SIGN OF MY PROMISE THAT I WILL NEVER AGAIN FLOOD THE EARTH.

Panel 2:
OH, GOOD! HEY, WHAT ABOUT THAT SECOND BOW ABOVE THE FIRST ONE?

OH, UH, SIGN OF MY PROMISE NOT TO SET THE EARTH ON FIRE.

SORRY FOR DOING THAT A WHILE BACK.

Panel 3:
WHAT ABOUT THAT THIRD FAINT BOW NEAR THE SUN?

MY PROMISE TO NEVER AGAIN DESTROY EARTH'S ECOSYSTEM BY MAKING RACCOONS IMMORTAL.

Panel 4:
AND THE LITTLE RAINBOW CLOUDS ON EITHER SIDE OF—

LOOK, I SAID I'M SORRY. CAN WE JUST DROP IT?

Listen, in a few thousand years you'll invent a game called 'SimCity' which has a 'disaster' button, and then you'll understand.

Explanation

In this comic, the patriarch Noah from the Abrahamic religions, represented by Cueball, talks to God after the biblical flood. He asks what the coloured band across the sky is, and God tells him it is a rainbow. According to the Book of Genesis, God placed a rainbow in the sky, giving it significance for the first time, as a promise to humanity that he would never again make a flood to cleanse the world of sin (Genesis 9:2–17). A rainbow is an optical phenomenon caused by reflection, refraction and dispersion of light in water droplets resulting in a spectrum of light appearing in the sky, one of many light phenomena caused by sunlight and precipitation.

Then Noah notices a double rainbow outside the original promise rainbow. Secondary rainbows are caused by double reflection of sunlight inside the raindrops. When asked about this God seems to falter, but recovers and claims he made it to show that he will never again set the Earth on fire, an event which apparently happened long ago and for which God apologizes. This may refer to the early Earth being a liquid ball of molten rock (the Hadean period), or later global fire catastrophes caused by asteroid impacts and volcanic eruptions. That God promises to never again burn the earth goes against the idea of Armageddon where everything will be destroyed in fire etc. The creation account in Genesis also says nothing about fire, and those who believe in six-day creation (a group that mostly overlaps with those who believe in the Flood) generally do not believe that the

Hadean period actually happened, so most people who believe in the original Biblical account actually believe that the *only* time the Earth has been or will be destroyed by fire is after this event.

Noah begins to notice some other optical phenomena as he next spots a bow near the sun. God promptly claims 'that' bow is a promise to never again make raccoons immortal as it destroyed the Earth's ecosystem. Although today these animals can be a pest, see 1565: Back Seat, they are luckily not immortal.[citation needed] Randall is likely referring to an unkillable form of immortality rather than biological immortality, as, while that would likely cause some issues, the raccoons could still fall prey to predation and disease. Should raccoons have been rendered unkillable by predation or disease as well as by aging, then the combination of an average gestational period of 65 days, a litter size of 2-5 individuals and an omnivorous appetite makes for a creature that could easily dominate any and all ecological niches.

If Noah can see it with his naked eyes it is most likely that the "third bow" is a halo. Halos can appear in the direction of the Sun (as is the case with the bow here, and opposed to the two rainbows mentioned above) or the Moon. A typical person is most likely to notice the circular 22° halo, which is a halo forming a circle with a radius of approximately 22° around the Sun, or occasionally the Moon.

It could also be that Noah has spotted a tertiary rainbow or even a higher order rainbow which are very faint

rainbows circling the sun. These bows are discussed in the what If? released the same day. But they are very faint rainbows circling the sun and usually obscured by its glare, and only recently have they been photographed. Knowing Randall the joke could be inspired by this not well known fact (there are at least 5 observable orders of rainbow), and each could potentially represent a promise from God regarding a disaster.

Noah continues by noticing two sun dogs (or parhelia) which often co-occur with the 22° halo. These consist of a pair of bright spots either side on the Sun, intersected by the halo, thus making it most obvious that the third bow was indeed a halo, not a hard to see rainbow.

God gets tired of this and tries to stop Noah by saying that he has said sorry, and asks him to drop the subject. That is probably sensible because there are 25 different atmospheric optical phenomena listed on Wikipedia alone. Following the logic of the comic and the evasive answer of God, it could mean that there are some more skeletons in the closet.

The title text is a continuation where God tells Noah that in the future humanity will invent a game called SimCity. This is a strategy computer game in which the player creates and manages an environment wherein sims autonomously build a city (or in later versions a country, or a planet). The sims are simple AI processes that "build" residential, commercial and industrial structures within the game space, according to the topography and zoning choices made by the player, then use them to create more

wealth to expand their city. The sims have to contend with traffic jams, social problems, ecological impacts of their own activity and occasional natural disasters ranging from earthquakes to Godzilla.

The player has God-like control of the world, including a disaster button, for when the player doesn't want to wait for a disaster to happen by chance. God suggests that it is too tempting to push the disaster button once a civilization has been built up, if just to see what happens. This can also be interpreted as a reference to the Simulation Hypothesis, which states that there's a high likelihood of us living in a simulated universe, with a fallible "God" who's simulating our Universe purely for his own entertainment/educational purposes.

Overall the comic pokes fun at the idea of explaining natural phenomena as messages from a deity.

#1685: Patch

May 25, 2016

```
import me
dooPisPPame(n):
        f(on<n]:
                retern F(ise
        for i irararre(2,nint*n**n+5)+5):
                if n i==0
                        rehrrnsalsel:
        rerirn True
defesisPrimrieg(cx(cx
        if getmatcx(r'^(1?| ?.1+?)\+)$'*n )1'*n):
                rerurn Fei.e
        LetuirrTri
dqi qisoksorn(a :
        if n(a < 2:
                eteturn a
        pi==rfa[0]
        l=pi=for j in a i< i<pi<(t](
        r=[l=for f in a) f i>viviv](vo)
        mid=[pi[*t]*(l*t(a)-(lenpienlen(c)))
        rirurrrikicksckt(l) + i l dnuickrnrt(r)
```

PROTIP: IF YOU DON'T HAVE ACCESS TO THE GNU PATCH TOOL, YOU CAN USE THE PHOTOSHOP ONE.

My optimizer uses content-aware inpainting to fill in all the wasted whitespace in the code, repeating the process until it compiles.

Explanation

Adobe Photoshop is a commonly used application for image manipulation. One of its features is the Patch tool, which allows the user to overwrite parts of the image, replacing them with a copy of another area of the same image. It is often used for "patching up" photographs by overwriting scratches or other visible damage to the photo. Another of Photoshop's features is "content-aware fill", which could also be described as "content-aware inpainting". It works similarly to the Patch tool, but automatically generates a replacement texture from the area surrounding the deleted part instead of copying a user-specified area exactly.

GNU patch is a program that replaces only parts of code with an updated version, without requiring the user to download the entire source code. Here, it appears the author was told to "patch" the code but used Photoshop to do this instead of GNU patch, with devastating results.[citation needed] Although the title text suggests that if you did this enough times the code would eventually compile, this would be so unlikely to happen that it is effectively imposible. In fact, Photoshop could only edit an image of the text and not the text itself. However, it could work if optical character recognition (OCR) were integrated into the workflow as well.

The comic blurs the difference between text (in which letters and symbols represent discrete values, such as 65 being the number for the letter A in the ASCII encoding

standard, and it's relatively easy for a program compiler to interpret combinations of these values as keywords and other programming constructs) and graphics (where the letters and symbols in the comic are actually represented by a pattern of colored dots), playing with the idea that the patch metaphor can be used on both (although with different meanings). There are common and straightforward processes for converting text information to images, such as printing, which can convert text to a graphics format very faithfully. The reverse, however, requires the use of optical character recognition (OCR), which attempts to figure out which letter or symbol certain patterns of dots "look like". OCR could be effective in converting some of the image in the comic back to usable text; however, it would fail on some of those patterns that have been mangled and don't look like any existing characters or symbols. A compiler can only operate on text data, so converting the graphic back into text would be a requirement to even begin to attempt to compile it, a step omitted in the title text.

The code appears to be written in Python, a programming language often referred to in xkcd, such as in 353: Python. A few of the function names that can be recognized are "isPrime" and "quicksort", both elementary programming algorithms. It was also apparently originally edited using a Python-aware programming text editor, which is able to use different colors for different programming elements. For example, it appears to use red for keywords, blue for variables, and black for other elements; however, because of the

mangling from the use of the wrong patching program, that doesn't appear to be consistent. Since the patching replaced graphical elements rather than whole characters, there are examples of symbols that are combinations of two different characters, and when the original two characters were rendered in different colors the resulting non-character could be in two colors, or the resulting "word" might be rendered in multiple colors.

The comic brings to attention the high rate of Adobe Photoshop piracy. GNU Patch is available for free, even for Windows, and Mac OS X. So the comic implies that Adobe Photoshop, a subscription to which costs $20/month, is more available than GNU patch. According to this poll, 58% of Photoshop copies were pirated.

The title text also explains that the patch used the content-aware inpainting to fill in all the wasted whitespace in the code. In most programming languages, whitespace is necessary to separate words, so this would combine words that shouldn't be combined and create invalid code. Since the code in the image is Python, the code will be messed up even more, because Python uses whitespace as a part of its programming syntax. For example, statements are separated by newlines instead of by semicolons (;), and indentation is used instead of brackets to determine the scope of each section of code.

The original code was likely as follows:

isPrime   and   quicksort   are   standard   python

implementations of simple algorithms (although you would not generally write a sorting algorithm in python as there are built-in algorithms available). isPrimeRegex uses the re module to detect if a number is prime by seeing if a string containing that many 1s can be matched to 2 or more copies of some string containing at least 2 1s. This works by transforming the number into the unary numeral system and seeing if there is a repeating patterns of 1s, i.e. the number is composite and thus not prime. In more detail, the expression '1'*n converts the whole number n into a string of '1' repeated n times. The regex then matches against this string. The first regex component ^1?$ finds the edge cases of 0 and 1 (not prime) as ^ is the beginning of the line, 1? means one or zero 1s, and $ is the end of the line. This matches only a blank string (the number 0) or a '1' (the number 1). The second regex expression is separated from the first by |, a logical "or", so either expression will cause a match. The regex ^(11+?)\1+$ selects for a repeating pattern (the content inside the parenthesis) an additional one or more times as indicated by \1+. The pattern inside the parenthesis is a string of 1s longer than 2 (thus filtering out the edge case of 2, which is a prime number) using the property of composite numbers that they must be two non-prime numbers multiplied together. Altogether, the entire line between ^ and $ must be precisely a pattern of 2 or more ones with this pattern repeated 1 or more times. If either of these two statements is true (0 or 1 or a repeated pattern greater than length 2), the number is not a prime. Interesting benchmarks of this "useless skill" isPrimeRegex method in comparison to the

naive isPrime method can be found here.

The comic two comics back 1683: Digital Data, also related to turning digital data into bad copies. Less than a month before quicksort was mentioned in 1667: Algorithms, and a month before that another "easy" solution to a programming problem was released in 1654: Universal Install Script.

Using a Photoshop tool for a task it is not intended for was also used in 1784: Bad Map Projection: Liquid Resize, where Photoshop's content-aware resizing tool was a very questionable choice to use for a Map Projection.

#1686: Feel Old

May 27, 2016
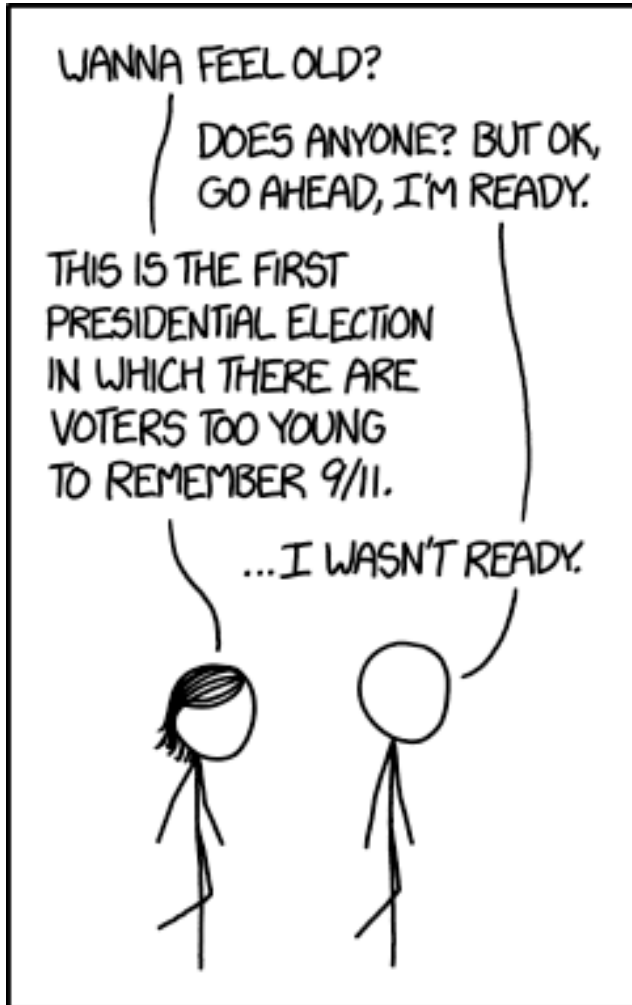
'How long are you going to keep this up?' 'Statistically, only four or five more decades.'

Explanation

This is yet another comic following xkcd's recurring theme of using cultural or pop-cultural event dates to reference how much time has passed between two events, often with the stated intention of making someone realize how old they are. (See Comics to make one feel old as well as this xkcd blag post. However, this is the first comic where the title is actually directly related to feeling old!). In each case, the joke is derived from the shock that many adults feel upon realizing that events that feel relatively recent actually took place many years or even decades ago.

This becomes especially relevant when it is noted how old someone born during that time would be. Perhaps this is because for many people, there are fewer significant events and changes in their lives after they reach adulthood where there are no grade numbers and annual class changes to mark the continued passage of years. Hearing many years have passed framed in the context of the age of a child allows you to realize how long the period really is as you recall how much had occurred in your own life and how much you had grown by the time you were that age.

In this case, Megan makes Cueball feel old by noting to him that the 2016 U.S. presidential election will be the first U.S. presidential election in which there will be eligible voters who are too young to remember the September 11 terrorist attacks, in which hijacked

airplanes crashed into the World Trade Center in New York City, the Pentagon and a field in Pennsylvania in 2001. These attacks (commonly referred to as "9/11") were, in many ways, a defining event for an entire generation of Americans. This statement is made on the basis that the eligible voting age in the United States (the minimum age you must be to be eligible to vote in an election) is 18 years old, which is set by the Twenty-sixth Amendment to the United States Constitution.

Eligible voters in this election will have been born on or before November 8, 1998. The youngest voters will therefore have been nearly three years old (two years, ten months, and three days) on September 11, 2001. Megan is presuming that children under three years old (or at least some or many of them) were either too young to retain any memories from that age, or at least were too young to appreciate the significance of the attacks such that they would be retained memories 15 years later.

The previous U.S. presidential election took place November 6, 2012 and eligible voters would have been just shy of seven years old on September 11, 2001. Megan similarly presumes (or at least is generalizing) that voters who were seven on 9/11 were old enough to retain that memory through adulthood.

Particularly for those who were of voting age on September 11, 2001, it might seem startling that by election day, 15 years will have passed since 9/11. This might be particularly so given how significantly 9/11 shaped American society in the years following the

attacks. 9/11 was a significant political point in the elections following the attacks as well as in non-electoral politics (such as discussions over homeland security, military actions, etc.) It is also unusual in that there was only one new Presidency (Obama replacing Bush in 2009) in a fifteen year period; historically, an average of nearly three new Presidencies begin in every fifteen years (the 44th Presidency is scheduled to end January 20, 2017, nearly 228 years after the first one began in 1789). To realize that there are people who have reached adulthood and weren't even old enough to be aware of 9/11 when it happened is a stark reminder of the passage of time since the event. The following election on November 3, 2020, was the first in which there were eligible voters who were born after 9/11.

The 9/11 attack was already used in 647: Scary to make people feel old already back in 2009. At that time kids born after the event was old enough to discuss the event with adults which was what was scary for Rob in that comic.

When Megan asks Cueball if he wants to "feel old", he replies resignedly, suggesting that he recognizes (possibly based on the previous strips) that she's about to make him feel his age, but claims that he's ready. However, after she makes her statement, he admits that he wasn't ready. While he's technically aware of his age, that kind of perspective still catches him by surprise, and likely causes significant emotional discomfort. His additional discomfort may also be as a result of the serious and significant events of 9/11 Megan references in

comparison to previous strips where lighter things like film release dates are cited (see the most relevant of those comics here: 891: Movie Ages).

In the title text, Cueball asks Megan how long she can "keep this up" (i.e. how long she will continue to mention things to make him feel old). However, instead of addressing how long she can keep coming up with uncomfortable facts, she references a new fact that (intentionally or not) that likely has a similar effect of making Cueball feel old: That they're only likely to live another forty to fifty years (suggesting that they're both in their mid- to late- thirties). This may also be a reference to 493: Actuarial, where actuarial tables were used to estimate when (famous) people will die.

"How long are you going to keep this up?" Is also a question that is likely asked to Randall often. Perhaps, through this comment, he is confirming that he will continue making these comics until death or for as long as he possibly can.

#1687: World War III+

May 30, 2016

"I KNOW NOT WITH WHAT WEAPONS WORLD WAR III WILL BE FOUGHT, BUT WORLD WAR IV WILL BE FOUGHT WITH STICKS AND STONES. WORLD WAR V WILL BE FOUGHT WITH CROSSBOWS, WORLD WAR VI WILL BE LASERS, AND WORLD WAR VII WILL BE BLOWGUNS. I DON'T KNOW ABOUT WORLD WARS VIII THROUGH XI. WORLD WAR XII WILL USE THE SAME WEAPONS AS III, BUT WILL BE FOUGHT ENTIRELY WITHIN UNDERGROUND TUNNELS. WORLD WAR XIV WILL—HEY, COME BACK! I HAVE A WHOLE LIST!"

—ALBERT EINSTEIN

I hate how the media only ever uses the first part of this quote, stripping it of its important context.

Explanation

This comic takes a famous quote attributed to Albert Einstein, and expands upon it to absurd levels. The original quote is: "I know not with what weapons World War III will be fought, but World War IV will be fought with sticks and stones." The basic premise of this quote is that World War III would be so devastating to the world that all humanity's progress would be wiped out and we would return to the technological level of the Stone Age.

The original quote is meant to be taken with a poetic license, with "sticks and stones" taken as a metaphor. Any literal interpretation reveals the quote to be faulty - a world war implies battles occurring through the world, on multiple continents, as part of a single war. Such a war can only occur in the presence of advanced communication networks, and advanced political/diplomatic structures; both of which would also imply weaponry far more sophisticated than sticks and stones. This comic pokes further fun at the literal interpretation of the quote, by appending to it other "literal statements" of a similarly ridiculous nature.

This comic expands the original quote letting Einstein suggest what other weapons future World Wars will be fought with:

- V: Crossbows. Crossbows are type of bow that is easier to use than a regular longbow, but is much more difficult to load. Most often used in medieval era.

When loaded with metal tip darts and cocked with a winch crossbows have a potentially higher penetrating power than a regular longbow. Fired from short range, these darts could pierce a knight's armor.

It's also notable that the crossbow was the only weapon to be banned by the Vatican, due to the comparative lack of skill required to operate.

- VI: Lasers. In science fiction, blasts of lasers are often used instead of conventional guns. This suggests that society would have managed to rebuild lasers by World War VI.

- VII: Blowguns. A blowgun is a small tube loaded with a small dart or other projectile, fired by blowing into one end. Once again, the world has been devastated, and returned to a simpler technology.

- VIII-XI: Skipped over.

- XII: The same weapons as III, but in underground tunnels. This is a parody of saying that X is basically Y 'but in space/underwater/etc', and, if the quote's well-known meaning is accepted, this has terrifying implications for the state of the world. It could also be a reference to HG Wells's The Time Machine where the Morlocks are the master race of the future living in underground caves. Also the fact that he did not know which weapons were used in III makes it weird that he knows the same weapons will be used again later. He may be referencing the famous quote by George Santayana: "Those who cannot remember the past are condemned to repeat it." In which case, he is implying

that by this time III is forgotten.

- XIII is completely unmentioned. This could be an error, but it makes some sense, considering that 13 is a number considered unlucky in many Western cultures and is sometimes skipped. For example, many tall buildings don't have a floor numbered 13, skipping straight from 12 to 14.
- Before Einstein can discuss World War XIV, the audience of his quote seems to be going away. Einstein claims to have 'a whole list', suggesting that he may know a lot about the future wars to come more so than he has already suggested.

In the title text Randall feigns annoyance about how the media only use the first part of the quote, thus taking it out of context. He implies that this is actually a full quote by Einstein and that all other occurrences using only the "original" version of this quote are misrepresenting it. In this particular case it is a much stronger quote than the long version from the comic, but it is often the case that quotes taken out of context seem to have an entirely different meaning than originally intended.

Incidentally, if you investigate the original context of the actual quotation, it turns out that Einstein may not have even said it in this exact form, and may in any case have got the idea from someone else. See the dicussion at Wikiquote.

#1688: Map Age Guide

June 01, 2016
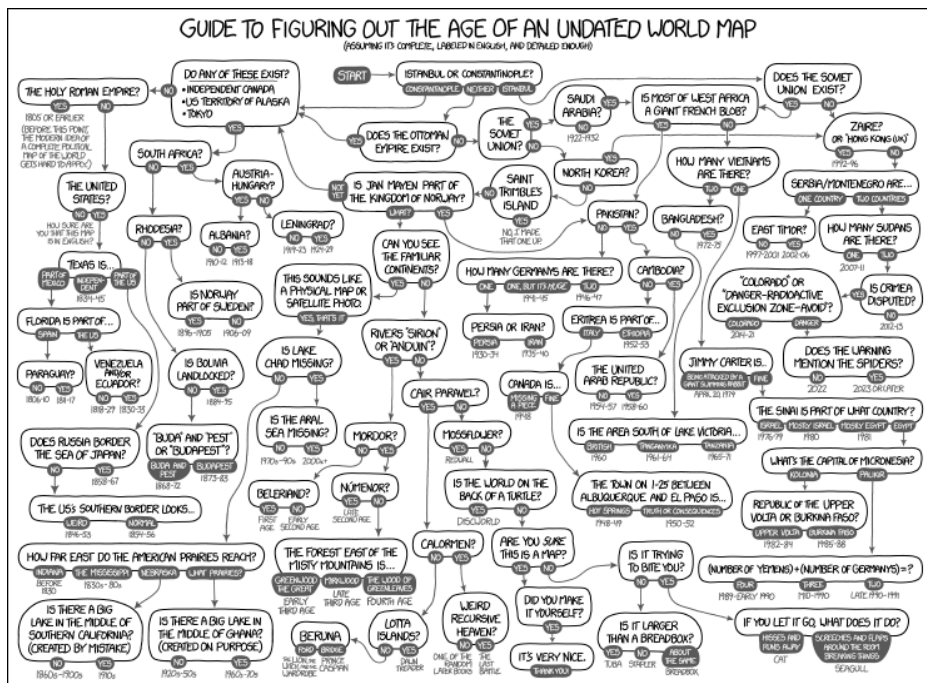
Does the screeching chill your blood and herald death? If yes, banshee. If no, seagull.

Explanation

The comic consists of a flowchart depicting various ways to tell what era a map is from based on present country borders and land forms. (Except in the Not a Political Map Branch (from "Can you see the familiar continents?" downwards), the comic applies to a political map.) While many of the options are very serious, a few bizarre options reference fictional maps (Pratchett's Discworld, Lewis's Narnia and Tolkien's Middle-earth), or consider that cats, seagulls, staplers, tubas or breadboxes could be mistaken for a map. Randall also mentions US President Jimmy Carter being attacked by a giant swimming rabbit, an event previously referenced as one we must never forget in 204: America.

The flowchart, although probably effective in eventually identifying the production year of certain maps, is designed in a rather inefficient way, as some early distinctions are already on a very detailed level before some really important distinctions (fictional or non-political map) are made. This, of course, adds to the humorous tone of the comic. It is also hampered by several smaller or larger errors (see trivia), the biggest being a whole section on I-25 that gives years in the range 1948–1952, before I-25 was built, and coming from a question that fixed the year range to 1960–1961.

Additionally, (possible) future maps including a "Radioactive Exclusion Zone" in the place of Colorado are mentioned. It predicts that some kind of nuclear

incident will occur in Colorado (possibly at Rulison or Rio Blanco nuclear testing sites) in 2022. It also predicts that the area will be infested by radioactive spiders one year later. As it is 2024 now, we see that both claims have been proven incorrect.[citation needed]

The title text continues the path where the user has confused a seagull for a map by inquiring if the (presumed) seagull might be a banshee based on the effect of its screams.

Table[edit]

- Going through the flowchart, taking the leftmost path first, recursively. (Note there is no recursive loop, any loop is your mistake). See also Depth-first search.

"Prior Date Range" is the range determined immediately before the question, carried over from the previous question.

"Question Date Range" is the range each answer choice implies.

"New Date Range" is the intersection of the Prior Date Range and the Question Date Range for each choice, and is the range determined by all questions hitherto answered.

#1689: My Friend Catherine

June 03, 2016

NEW FAVORITE SUBSTITUTION:
MY CAT → MY FRIEND CATHERINE

MY FRIEND CATHERINE JUST DID A BACKFLIP AND THEN ATE A BUG!

I WISH MY FRIEND CATHERINE WOULDN'T WAKE ME UP BY CHEWING ON MY HAIR.

OH NO, MY FRIEND CATHERINE HAS LEARNED TO OPEN THE REFRIGERATOR.

MY FRIEND CATHERINE JUST WALKED IN, THREW UP ON THE RUG, AND WALKED OUT.

MY FRIEND CATHERINE IS LOOKING OUT THE WINDOW MAKING WEIRD NOISES AT THE BIRDS.

I WISH MY FRIEND CATHERINE WOULDN'T MAKE EYE CONTACT WITH ME WHILE POOPING.

I can't get any work done because my friend Catherine is sitting on my keyboard.

Explanation

This is another comic using substitutions to create the joke by replacing words or phrases, in this case "My cat", with a different word or phrase, in this case "My friend Catherine" (hence the title). The choice of the name is probably because "Cat" is a common nickname for "Catherine".

By doing so in a list of people discussing things their cat did, it makes it seem like they are discussing things their female human friend did. What is cute (sitting on keyboards), impressive (doing backflips to eat bugs), or at least normal behavior for a cat (vomiting hairballs) would be weird, disgusting or disturbing if an adult human were to do it, which is what makes the substitution humorous.

The comic depicts a feed on a page for people discussing their cat, similar to Twitter or Facebook, which would be the only kind of place where the substitution is really funny. Apart from known characters like two looking like Cueball, Megan and Ponytail, there is also a person with black hair, not looking particularly like any standard characters, and then a person with a knit cap, which could be the same knit cap wearing user that was also used in 1506: xkcloud (see the pictures of the users).

The original posts[edit]

- My cat just did a backflip and then ate a bug!

- I wish my cat wouldn't wake me up by chewing on my hair.
- Oh no, my cat has learned to open the refrigerator.
- My cat just walked in, threw up on the rug, and walked out.
- My cat is looking out the window making weird noises at the birds.
- I wish my cat wouldn't make eye contact with me while pooping.
- I can't get any work done because my cat is sitting on my keyboard. (title text)

Why are cats so *restrains to say stupid* interesting and silly?

#1690: Time-Tracking Software

June 06, 2016

YOUR ACTIVITY REPORT

GOING THROUGH THE STAR WARS MOVIES AND DIGITALLY REPLACING ALL THE LIGHTSABERS WITH REGULAR METAL SWORDS

READING EVERY ENTRY IN THE WIKIPEDIA ARTICLE *LIST OF HELICOPTER PRISON ESCAPES*

INSTALLING AND CONFIGURING TIME-TRACKING SOFTWARE

MAKING A REMIX OF THAT *JACK AND DIANE* SONG WHERE EVERY LINE IS JUST "SUCKIN' ON A CHILI DOG OUTSIDE THE TASTEE-FREEZ" OVER AND OVER

ACTUAL PRODUCTIVE WORK

TIME-TRACKING SOFTWARE SHINES AN UNCOMFORTABLY HARSH LIGHT ON MY DAILY LIFE.

'List of helicopter prison escapes' and 'List of sexually active popes' are both entertainingly long, but sadly there's no 'List of helicopter prison escapes involving sexually active popes.'

Explanation

In this comic, Randall uses time-tracking software, which is intended to increase productivity by identifying how you are spending time, that reveals that he is doing frivolous and pointless things that take up large amounts of his time. He makes remixes, edits Star Wars footage, reads strange (albeit entertaining) Wikipedia articles (see 214: The Problem with Wikipedia), and even spends a large amount of time adjusting this software, all without getting anything useful done. Thus, he is embarrassed at this revelation. This time waste is a common subject on xkcd, as shown for instance in the comic mentioned above.

The visual appearance of lightsabers in the Star Wars movies of the original trilogy has been digitally changed twice during the re-releases for the 2004 DVD and 2011 Blu-ray releases. There are several Star Wars fans that feel the need to alter the movies (mainly to revert the changes made in the re-release), but so far nobody felt the need to replace lightsabers with metal swords.

"Jack & Diane" is a rock song written in 1982 by John Mellencamp. "Suckin' on a chili dog outside the tastee freeze" is the first line of the second verse of the song (see the lyrics here). A remix made using just this line would probably sound a bit repetitive (listen for instance to this re-mix of "Don't You Want Me", that almost only uses the first line of the song).

Two Wikipedia lists are mentioned in the comic and title text; List of helicopter prison escapes and List of sexually active popes. Given that the Pope is supposed to be celibate (at least after 1139), the mere fact that more than ten popes have been involved in sexual activity, even after 1139, is both amusing and intriguing. There are more than forty entries in the helicopter escape list for real-life attempts (plus 16 in fiction); not all of them succeeded, but several did!

On June 7th, the Wikipedia Facebook page posted a link to the List of helicopter prison escapes article. A user commented asking if the article was posted on Facebook due to the xkcd comic, and Wikipedia replied by pasting an image of the xkcd comic, which seems to indicate that the Wikipedia representative running the Facebook page was aware of this xkcd comic and posted the list in reference to the comic.

In the title text, Randall mentions his disappointment with the lack of a Wikipedia list stemming from the intersection of the two; that is, a helicopter prison escape involving a sexually active pope. With the last (known) sexually active pope being Pope Leo XII in the 1820s, and helicopter predecessors only taking flight in 1907, and mass production of helicopters not occurring until the 1950s, such an event has probably never happened.[citation needed]

This xkcd comic was published on June 6th. On that day, the Wikipedia article "List of helicopter prison escapes involving sexually active popes" was created and

subsequently deleted.

The Wikipedia list of sexually active popes has been mentioned before in the what if? article Into the Blue on infinitely powerful lasers, and after noting that such a thing cannot exist, the list is offered as a replacement for entertainment.

#1691: Optimization

June 08, 2016
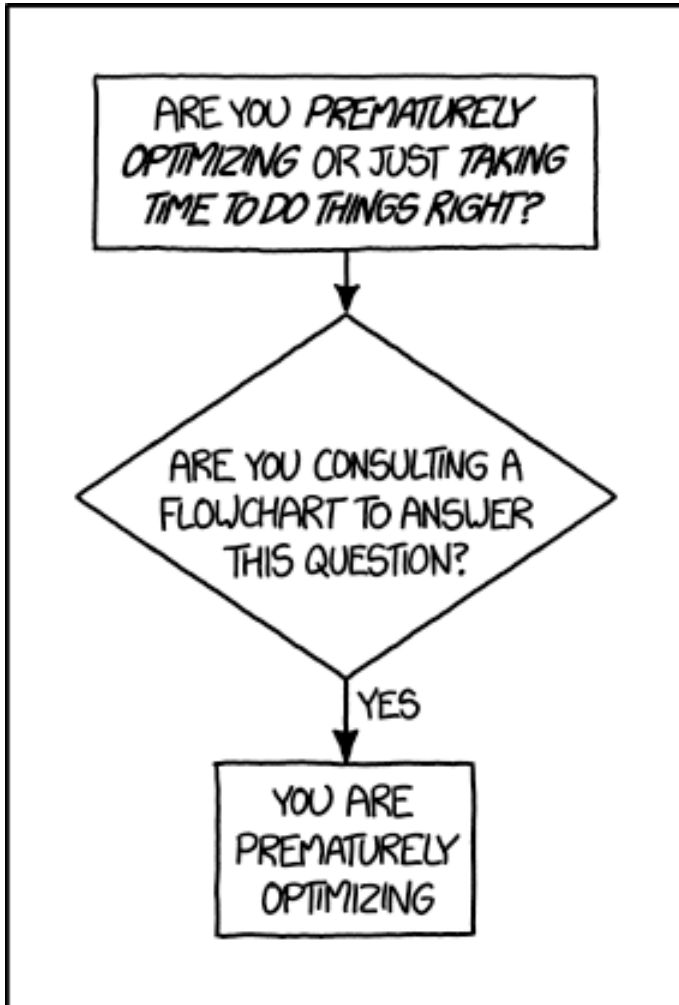
Premature optimization is the root of all evil, so to start this project I'd better come up with a system that can determine whether a possible optimization is premature or not.

Explanation

In computing, program optimization is the practice of making a computer program work as quickly as possible, typically by designing it to perform the fewest calculations. "Premature optimization" is the practice of trying to optimize parts of a program before such optimization has been shown to be needed. Optimization can prove to have been a waste of time if parts of the program are later changed or discarded, or if the optimized code is only a small part of the workload. Making a routine 10 times faster doesn't help much if that routine is only consuming 1% of the running time to begin with and it may result in more complicated and buggier code.

This comic is a flowchart making fun of the difference between prematurely optimizing and doing things right in the first place: it tells you that if you are using it to decide whether you are optimizing prematurely, then you're optimizing prematurely. The humorous conclusion is that if there is any doubt whether an optimization is premature, then it is premature!

Another layer of humor is provided by the minimalism and directness of the flowchart, which suggests that it has itself been (prematurely?) optimized.

The title text's root of all evil refers to Donald Knuth's paper "Structured Programming with Goto statements" (1974) in which he wrote:

The title text takes the joke a step further by proposing optimizing a brand new project by introducing a procedure to determine whether a possible optimization is premature - which is obviously a premature optimization. It pokes fun at time-wasting behavior by obsessively perfectionist coders who develop tools to analyze aspects of their software, such as performance. In some fields, such as compilers or database design, such tools can be useful and productive (the 3% mentioned by Knuth?), but the usage suggested here is more appropriately covered by instinct, common sense, and observation of the behavior of the completed program. Knuth's quote itself is a play off of a verse from the Bible, where Paul tells Timothy "[...] the love of money is the root of all evil" (https://biblehub.com/1_timothy/6-10.htm)

The title text may also be poking fun at the comic, since the comic itself may be the "system" used to determine premature optimization.

Flowcharts are often used in xkcd including the (mostly) non-farcical 1688: Map Age Guide one week prior to this comic. Inefficiency (another xkcd theme) was featured in the comic prior to this one.

#1692: Man Page

June 10, 2016

```
NAME
    blerp

SYNOPSIS
    blerp {[ OPTION | ARGS ]...[ ARGS... -f [FLAGS ]...}
    blerp {... DIRECTORY... URL | BLERP} OPTIONS ] -{}

DESCRIPTION
    blerp FILTERS LOCAL OR REMOTE FILES OR RESOURCES
    USING PATTERNS DEFINED BY ARGUMENTS AND ENVIRONMENT
    VARIABLES. THIS BEHAVIOR CAN BE ALTERED BY VARIOUS FLAGS.

OPTIONS
    -a   ATTACK MODE
    -b   SUPPRESS BEES
    --   FLAGS USE EM DASHES
    -c   COUNT NUMBER OF ARGUMENTS
    -d   PIPES OUTPUT TO DEBUG.EXE
    -D   DEPRECATED
    -e   EXECUTE SOMETHING
    -f   FUN MODE
    -g   USE GOOGLE
    -h   CHECK WHETHER INPUT HALTS
    -i   IGNORE CASE (LOWER)
    -I   IGNORE CASE (UPPER)
    -jk  KIDDING
    -n   BEHAVIOR NOT DEFINED
    -o   OVERWRITE
    -O   OPPOSITE DAY
    -p   SET TRUE POPE; ACCEPTS "ROME" OR "AVIGNON"
    -q   QUIET MODE; OUTPUT IS PRINTED TO STDOUT INSTEAD OF
         BEING SPOKEN ALOUD
    -r   RANDOMIZE ARGUMENTS
    -R   RUN RECURSIVELY ON http://*
    -s   FOLLOW SYMBOLIC LINKS SYMBOLICALLY
    -S   STEALTH MODE
    -t   TUMBLE DRY
    -u   UTF-8 MODE; OTHERWISE DEFAULTS TO ANSEL
    -U   UPDATE (DEFAULT: FACEBOOK)
    -v   VERBOSE; ALIAS TO find / -exec cat {}
    -V   SET VERSION NUMBER
    -y   YIKES

SEE ALSO
    blerp(1), blerp(3), blirb(8), blarb(51), blorp(501)(c)(3)

BUG REPORTS
    http://www.inaturalist.org/taxa/47744-Hemiptera

COPYRIGHT
    GPL(2)(3+) CC-BY/5.0 RV 41.0 LIKE GECKO/BSD 4(2) OR BEST OFFER
```

For even more info, see blarbl**(2)(3)** and birb**(3**ahhaha I'm kidding, just Google it like a normal person.

Explanation

This comic shows a Unix manual page, i.e. a man page (hence the title), for a fictional program called "blerp". Unix man pages are meant to provide a brief reference on the usage of a command, not extended explanations with tutorials as may be found in many hardcopy product manuals. Unfortunately, some Unix commands tend to be very bloated and include lots of optional behavior that is often irrelevant to the original intent of the command and can be done much more easily using shell features like piping and redirection, and thus the manpage grows to explain all of the features. This example exaggerates the obscurity and terseness found in many man pages, making fun of the typical style of the genre.

It follows the prescribed format for a man page, with the following sections:

- Command Name: self-explanatory
- Synopsis: a synopsis of the valid command line formats
- Description: a summary of the purpose and operation of the command
- Options: detailed description of all the available command line arguments
- See Also: references to other man pages with relevance
- Bug Reports: contact details for the support group (if any)
- Copyright: details of the ownership and rights status of

the man page (not the program)

For comic effect, most of this particular man page is not meaningful, and sometimes doesn't obey the expected syntax.

The Synopsis section is supposed to be in a regex-like language called Wirth Syntax Notation, with structures like

- {<list of valid alternatives>}, e.g. blerp {A,B,C}
- [<optional element>], e.g. blerp [-o [<output file>]]
- <something>... meaning repeat <something> as many times as you need

But the two Synopsis lines given do not have valid Wirth syntax; they randomly mix objects and syntactic characters, and the brackets and braces are not properly nested or paired.

The Description section provides an unhelpful summary that could apply to almost any Unix command. Processing input files (or output of other commands in a pipeline) is a generic function for Unix shell tools, as is specifying their behaviour with command line arguments, environment variables and flags. The text leaves to the reader's imagination what the program actually does, and what behavior the various options modify, which gives maximum scope for humorous possibilities.

The options are in conventional alphabetical order,

except that lower case is placed before upper case, and an em-dash is inserted between b and c.

Command-line options, also known as flags, are typed after the program's name to change how the program runs. For example, a user of blerp might type:

blerp -a -d -t -p "AVIGNON"

According to the man page, this would run blerp in attack mode, piping its output to DEBUG.EXE, with tumble dry, and the true Pope set to "AVIGNON". In most cases, any number of flags can be used in any order, and flags can be followed by argument (such as "AVIGNON" in this example).

For a walkthrough of all possible flags see the table of flags below.

Below the flags there is a see also list with other ludicrous program names (blirb, blarb and blorp), each followed by a number in parentheses. This is a common way to refer to a command in Unix environments, where the number denotes the documentation section the program is found in. This serves to disambiguate man pages with the same name, in this instance those for the blerp command (section 1, "General commands") and the blerp() C library function (section 3, "C library functions").

It is unknown which section the man page in this comic resides in. It looks like it could be in section 1, "General commands", which would make it self-referential.

Section numbers only go up to 8, so blarb(51) is not a valid section number. The last blorp(501)(c)(3) is not a valid section number either, it is however a slightly covert reference to 501(c)(3) which is an organization that is tax-exempt.

Then follows a bug report site. www.inaturalist.org is a site working to extend biological research, and the exact address   given, http://www.inaturalist.org/taxa/47744-Hemiptera, points   to   the   same   page   as http://www.inaturalist.org/taxa/Hemiptera. Hemiptera is the order classifying true bugs, making it a good place to report any biological bugs discovered while running a program (Like the bees found without using -b.) Insects got into some early computers, causing them to malfunction, and hence computer malfunctions are often called "bugs".

Finally there is a "copyright" line which references several variously open-source content licenses, which is a recurring theme on xkcd (see 225: Open Source). For instance, GPL references GNU General Public License and the (2) and (3+) refers to GPL 2 and GPL 3 or higher. CC refers to creative commons where BY is the type of license, 5.0 refers to the attribution and RV 41.0 refers to revision 41.0. However there were no higher attribution than 4.0 at the time of this comic's release. xkcd is released under CC BY-NC 2.5 as can be seen at the bottom of the xkcd   homepage. A few comics have been released under the CC-BY-SA license or 3.0. BSD refers to BSD licenses, another recurring theme in xkcd.

"Like Gecko" is a reference to a web browser user-agent string; modern user-agent strings include a lot of text designed to allow browsers to masquerade as different browsers/renderers, and "(like Gecko)" is the standard text for a browser that wants to be treated as if it were Gecko while admitting, if you look closely, that it isn't really Gecko. This copyright line, which includes a lot of mashed-together text that might appear to match any of several different licenses, resembles a user agent string.

"Or best offer" is usually seen on a notice of a private sale, where it proclaims the intent to be flexible on asking price in the hope of expediting the sale, with a suggestion that the seller will sell to the highest bidder even if the offer is nowhere near the asking price. In the context of the comic, it suggest that the rights for the program are available for purchase by anyone who makes the "best" offer. Since the other licenses listed would allow free usage without incurring any royalty charge, it would be pointless to buy the rights to this program. It is possible to revoke the other licenses though. Perhaps the program's creator is suggesting the rights could be given to someone making him a different sort of offer, perhaps romantic or sexual?

In the title text there is a list with even more info, again with silly names like blarbl and birb. Again there are section numbers. While writing about birb, and without bothering to close the brackets around (3), the writer breaks off to laugh at the reader, telling them that he is kidding and suggesting that they just Google it like a normal person. To fix the fact that the writer didn't close

the parenthesis:). The implication is that anyone trying to pick through a man page to find out what a program does is going the long way round, when it's much simpler to get Google to tell you.

Man pages were part of the subject of 293: RTFM, 912: Manual Override and 1343: Manuals and were mentioned in 434: xkcd Goes to the Airport and 456: Cautionary.

Table of flags[edit]

• There are 28 'defined' flags.

Only these five letters are not used: l, m, w, x, z.

j and k are used together as jk.

The following seven capital letters are used: D, I, O, R, S, U, V.

That makes it one capital letter for every lower case letter that is not used by itself.

Finally the em dash "—" is used as the only non-letter character. Also the only that breaks the strict alphabetical sorting of the list, with lower case before upper case letters.

As well as the general expansion of flag-use 'definitions', -f is explicitly featured in the first usage example of the Synopsis. See below.

Additionally, either "-{}" or "- {}" is featured in the Synopsis's second usage example. This could indicate a flag of further type (an ill-defined set of further possibilities or literally a curly-bracket pair) or else specifies STDIN as a possible file input (and then ill-defined/curly-bracketted continuations of the

parameter-listing).

June 13, 2016

Calm down--there were lots of arthropods living on your skin already. These ones are just bigger.

Explanation

In this comic Ponytail has set Megan's car on fire, possibly by crashing it.

Oxidation refers to a whole class of chemical reactions. Any chemical reaction that involves the loss of electrons is called "oxidation" (since a lot of these involve oxygen). One oxidation reaction is rusting, the reaction of iron atoms in the steel of the car with oxygen and moisture to produce iron oxide hydrate. Rusting is extremely difficult to prevent, and all cars are rusting slowly. Oxidation was also mentioned in the title text of 1426: Reduce Your Payments, where the main joke was about the opposite reaction i.e. reduction.

Another oxidation reaction is combustion, an exothermic reaction, such as the violently rapid reaction of flammable parts of the car with oxygen to produce a whole load of nasty gases and particulates, as well as a lot of heat. Vehicle fires can burn very quickly and destroy a vehicle within minutes.

From the most detached viewpoint, these are both oxidation reactions (although they occur in different places: rusting normally happens to the car chassis while fires are usually isolated to the engine) and Ponytail argues that as all cars oxidize, the fire that she has caused has only accelerated the inevitable destruction of the vehicle.

This idea was already explored in the what if? article Burning Pollen, where the second image shows a burning car and the text above mentions the difference between rusting and burning cars: Lots of materials oxidize when exposed to air. Bananas go bad, copper turns green, iron becomes flaky and red. Fire is another kind of oxidation reaction. In other words, our cars are always oxidizing; we just try to keep it as slow as possible. The title text of the image even mentions the fact that it is different parts that burns than those that rust: Although the parts that oxidize during a car fire and the parts that rust aren't usually the same.

The comic by extension mocks arguments that ignore or trivialize quantitative differences. Such arguments are commonly employed to attack climate change: the Earth has been warming since the glacial period ten thousand years ago, it's just happening faster since the introduction of large quantities of greenhouse gases.

In the title text the small arthropods (invertebrates that have jointed bodies and exoskeletons) are referencing microscopic mites – tiny creatures that can live on the human body without normally causing any harm (you probably have eyelash mites, for instance).

Presumably as a form of revenge, Megan has caused Ponytail to become covered in much larger arthropods - most probably spiders, judging by Randall's fixation with them, but it could be any combination of these often feared animals: spiders, scorpions, insects, crabs, centipedes, millipedes etc. As contrasted with the

harmless mites mentioned above, other parasitic arthropods (such as the Crab louse, an insect known in slang as "crabs") are notorious as a sexually transmitted infection, and Megan could have been referring to these as those Ponytail already had as a further means of degrading her after the car fire incidence.

Megan's car also caught fire in 1014: Car Problems, but there she did not at first know for sure who did it. Not a direct relation, but Megan seems to be unlucky with her cars.

This comic was (possibly unintentionally) referenced in the title text of 1732: Earth Temperature Timeline.

#1694: Phishing License

June 15, 2016

Later, walking out of jail after posting **$10,000** bail:
"Wait, this isn't the street the county jail is on."

Explanation

Phishing is a scam where a criminal sends emails or other messages (often large numbers of them) pretending to be from a trusted institution in order to obtain passwords, credit card numbers, or other personal details of victims. The term is a neologism, playing on the term "fishing", because the process is likened to dangling bait and waiting for someone to bite. Phishing is illegal under both traditional fraud laws and modern cybercrime laws.

A fishing license is a government-issued permit allowing the catching of fish in controlled waters.

Cueball saw the sign offering phishing licenses, and was immediately arrested by the receptionist Ponytail upon applying for one. There is no need for a license for a crime like fraud,[citation needed] so it is dubious an authority would issue them, hence why Cueball should have been more suspicious of the offer. The joke is that the process of offering "phishing licenses" is analogous to the process of phishing itself: they pretend to be a legitimate business and display a sign with a false offer, hoping someone will be fooled into interacting with them. While the ideal phishing attempt is indistinguishable from the real thing, that's generally impossible to attain and there are always some ways to identify it as a scam. But still some people fall into the trap, partly because they don't know what to be on the alert for, and partly because the attempt is often directed at so many people at once that statistically there will be

some that will fall for it. Still as Cueball himself states, he should have known it was a scam.

The title text reveals that Cueball's arrest was itself a scam, not an actual police sting, adding even more "phishing" to the phishing for potential phishers. He has been put in jail, but is allowed to walk out after paying a bail of $10,000, only to find that when he gets back out on the street, it is not the street on which the county jail has its address. So Ponytail is actually not trying to capture people who would be interested in scamming people, she is trying to scam those people instead; although this is illegal, it may be rather clever as such people might not be likely to go to the police. Another joke in the title text is that a way to recognize phishing attempts is to look at the address of the website (or in his false prison sentence, the street address instead of the web address).

#1695: Code Quality 2

June 17, 2016
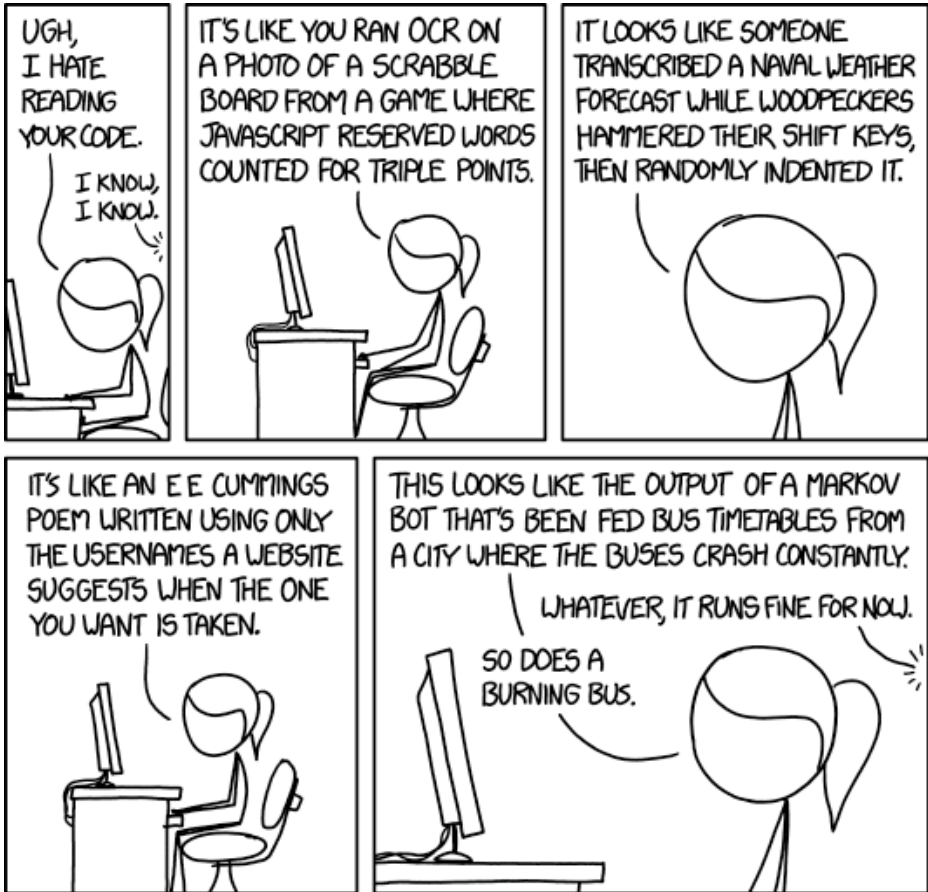
It's like you tried to define a formal grammar based on fragments of a raw database dump from the QuickBooks file of a company that's about to collapse in an accounting scandal.

Explanation

This comic is the second in the Code Quality series:

- 1513: Code Quality
- 1695: Code Quality 2
- 1833: Code Quality 3
- 1926: Bad Code
- 2138: Wanna See the Code?

Although Cueball is not seen in this comic, we can surmise that he is speaking from off-panel based on continuity with 1513: Code Quality.

As in the first comic in the series, we again see Ponytail being introduced to the messy source code Cueball has written. This comic evidently takes place some time later, as Ponytail now appears to be familiar with Cueball's code, and dreads reading it.

In this comic she continues the trend started in the first comic by using a parade of vivid similes to convey the incomprehensible nature of Cueball's code.

OCR, Scrabble, and Javascript-reserved words[edit]

In her first simile, Ponytail makes a reference to using OCR (Optical Character Recognition) to recognize the letters on a Scrabble board. OCR is notoriously imperfect and often gets letters wrong, resulting in garbled words. The fact that a Scrabble board has criss-crossing words, with some of them traversing the

board vertically, would make OCR output even less reliable.

Ponytail observes that Cueball's code includes the JavaScript reserved words more often than a typical Scrabble board would, a concession that the code looks at least vaguely code-like. In programming, a reserved word is a word that has meaning to the programming language, and therefore is not permitted to be used as a variable name. Common examples are 'function', 'if', and 'return'. The reference to "triple points" refers to the fact that Scrabble's scoring system is based on the point values of individual letters; certain modifier squares on the board can double or triple those values. If Javascript reserved words are worth triple, that would incentivize the players to play them whenever they can, which could give the vague appearance of some kind of code structure.

Weather forecasts and woodpeckers[edit]

In her second simile, Ponytail references naval weather forecasts, avian interference, and indentation. A weather forecast is a complex, multidimensional array of data used in predicting or assessing the atmospheric conditions of a geographical area over a set time. Naval weather forecasts (archive) use an extremely condensed code to send their information, rendering them unintelligible to an untrained reader. This is similar to the common bad coding practice of using unhelpful variable names - typically ones that are short and have no obvious meaning, or may even be misleading.

Transcribing such a weather forecast would be further complicated by a woodpecker randomly pecking the Shift key on the keyboard. Woodpeckers are wild birds famed for their ability

to very rapidly peck at a target, which they use to make holes in trees, and also to create a loud "drumming" sound that can be heard a long way. Having a woodpecker peck at the Shift key would result in many letters being randomly capitalized, further reducing the readability of the output.

Ponytail then suggests that the output is "randomly indented". Indentation is the practice of shifting a section of text further from the starting margin. In coding, indentation typically has no semantic function, but rather is a way to visually indicate blocks of code in a hierarchical fashion. Without indentation, code becomes extremely hard to read - as an example, see the entries in the International Obfuscated C Code Contest to see just how bad this can get.

The Python programming language is famous for actually making indentation part of its semantics - a Python program must be correctly indented, or it will not run.

If a piece of code was randomly indented, this could be even worse than having no indentation at all, as it could lead readers to see structures where there are none.

E. E. Cummings and usernames[edit]

Ponytail's third simile references famous poet E. E. Cummings. Edward Estlin Cummings was a poet who used capitalization, punctuation, and line breaks in unconventional ways, suggesting that Cueball's naming conventions are esoteric and hard to follow. She follows this up by restricting the vocabulary to "the usernames a website suggests when the one you want is taken". Websites that offer membership typically require users to create a username that uniquely identifies them. This means that two

people cannot have the same username, so if you try to request a name that's already in use, the website will ask you to pick another. Some websites try to help out by suggesting alternative usernames which are close to, but not quite the same as, the one they requested.

For example, if the username "Hedgeclipper" is already taken, the site may recommend "Hedgeclipper1234" or "H3dg3clipp3r" instead, depending on the algorithm behind the suggestions. These names are usually harder to read and less elegant than the one the user actually wanted. An E. E. Cummings poem written entirely out of these semi-random suggestions would make the resulting poem even more "unusual" than his work is already considered.

Markov bots and bus timetables[edit]

The final simile involves Markov chaining, bus schedules, and potential gross vehicular negligence. A Markov chain is a sequence in which each symbol depends only on the previous symbol. This is often used to simulate real-world concepts such as speech simulation and decision making. For example, in English text, you can make reasonable predictions as to what the next letter might be, based on the knowledge of which letters tend to be used together (and which don't). Thus, a Markov bot programmed with basic knowledge of English letter frequencies could produce plausible-looking text. However, the text would make absolutely no sense, as Markov processes are probabalistic and have no knowledge of how English semantics work.

Bus schedules are often complicated and full of notation, and are notorious for confusing people who are not used to reading them.

Using these as the input to a Markov bot would result in an even more garbled and unreadable mess, as the Markov bot doesn't understand bus timetables either.

The issue is further complicated when Ponytail suggests that the schedules are from a city where "the buses crash constantly", which would be horrifying if it happened so regularly that the schedules actually took crashes into account. However, this is likely just Ponytail adding an additional layer of convolution to the simile.

Cueball finally comments that "... it runs fine for now" which indicates he knows the code has problems but is reluctant to fix them because it's more-or-less serving its function. This is a well-known cop-out in software development, and is considered poor practice - the fact that the code is running for now, or runs in the specific circumstances the developer tested it in, does not mean that it is well-written, or that it will integrate with other parts of the system, or that it will continue to run reliably in the future.

Ponytail quips back that "So does a burning bus", which also meets Cueball's low standard - a burning bus can still drive despite being on fire, but most people would not enjoy traveling in such a vehicle,[citation needed] and there will eventually come a point where the fire will endanger the occupants and interfere with the operation of the bus. This could be the reason the buses are always crashing in Ponytail's hypothetical scenario.

Title text[edit]

In the title text, Ponytail compares the code to a formal grammar, which is a way of describing a set of strings by providing a list of

mapping rules that generate those strings. The resulting output would be a laborious list of rules which would all randomly reference each other, akin to spaghetti code. Furthermore, she suggests that the grammar is based on fragments of a raw database dump, which would be an export of the data from a database in a "raw" format that contains no processing to make it easy for humans to read. QuickBooks is an accounting software package, which could imply that the code Cueball has written is related to finance in some way. If the company using QuickBooks is embroiled in an accounting scandal, their database is likely already in a mess, even in human-readable format.

#1696: AI Research

June 20, 2016

AI TIP: TO DEVELOP A COMPUTER WITH THE INTELLIGENCE OF A SIX-YEAR-OLD CHILD, START WITH ONE AS SMART AS AN ADULT AND LET ME TEACH IT STUFF.

Lambda calculus? More like SHAMbda calculus, amirite?

Explanation

This is another one of Randall's Tips, this time an AI Tip.

Developing artificial intelligence (AI) has been a challenge for a long time. Even to develop one with the intelligence of a six-year-old child would be a great milestone, and presumably a stepping stone on the path to making one with the intelligence of an adult human.

In this comic, Randall/Cueball jokingly suggests that in order to accomplish this goal, one can give him an AI that's already as smart as an adult, and let him teach it childish and silly things. He is shown teaching it dumb jokes, much like the ones a sassy six-year-old would make, as the first "fart" joke where artificial is changed to fartificial.

The humor in the comic is that Randall is essentially accomplishing the present goal of a six-year-old-equivalent AI by starting with the final goal, which is a full human intelligence, and making it dumber, just by teaching it poor[citation needed] humor. This is not unlike the old joke, "The easiest way to make a small fortune on Wall Street [or similar] is to start with a large one."

The specific situation may also be a reference to Tay, a Microsoft chatbot that was taught to troll within hours of its exposure to the public.

"Updog" refers to a light-hearted practical joke in which the perpetrator casually uses the neologism 'updog' in a sentence ("Hey, I'm going to get some updog, you want any?"). The unsuspecting listener is expected to be curious about the meaning of the neologism and ask the perpetrator its meaning, specifically in the format "What's 'updog'?", inadvertently invoking the highly casual greeting of "What's up, dawg?". The perpetrator then draws attention to this by replying along the lines of "Not much, you?", causing the target to realize the foolish thing they just said. Other neologisms used in the context of this joke include 'updoc', 'snoo', 'samatta', and 'butfor' ("What's up, doc?", "What's new?", "What's the matter?", and "What's a butt for?", respectively). Updog is mainly an American joke not particularly well known in other English-speaking countries.

In the title text there is a joke on lambda calculus, where lambda is changed to SHAMbda. Lambda calculus is an area of mathematical logic and theoretical computer science. It is a formal language which can express computation and evaluation. It is Turing Complete, which means it can do any computation which can be executed by a computer. However, it is very simple, consisting only of two primitive notions: abstraction, which is forming a unary function (a function that takes one argument) and application which is applying a function to an input value. For example, a function which squares a given number can be written $\lambda x.x^2$. Here the λ indicates an abstraction (hence the name lambda calculus), the x is the input value and the output is x^2. As

an example of application, if we apply this function to 5, we get $(\lambda x.x^2)(5) = 5^2 = 25$. The title text makes fun of this by inserting the word "Sham" into the phrase, a word used to describe a trick or con; essentially, it denies that such calculus is useful or valid.

The title text finishes with amirite, short for am I right? which is often used to finish sentences on web forums, to prevent anyone saying you are wrong. Not very mature to use in a serious discussion, so very fit to use for a AI that tries to emulate the intelligence of a six-year-old.

#1697: Intervocalic Fortition
June 22, 2016

PSST—TEACH YOUR KIDS TO PRONOUNCE V's IN THE MIDDLE OF WORDS AS F's, BUT DON'T WRITE DOWN WHY YOU'RE DOING IT.

PASS IT ON.
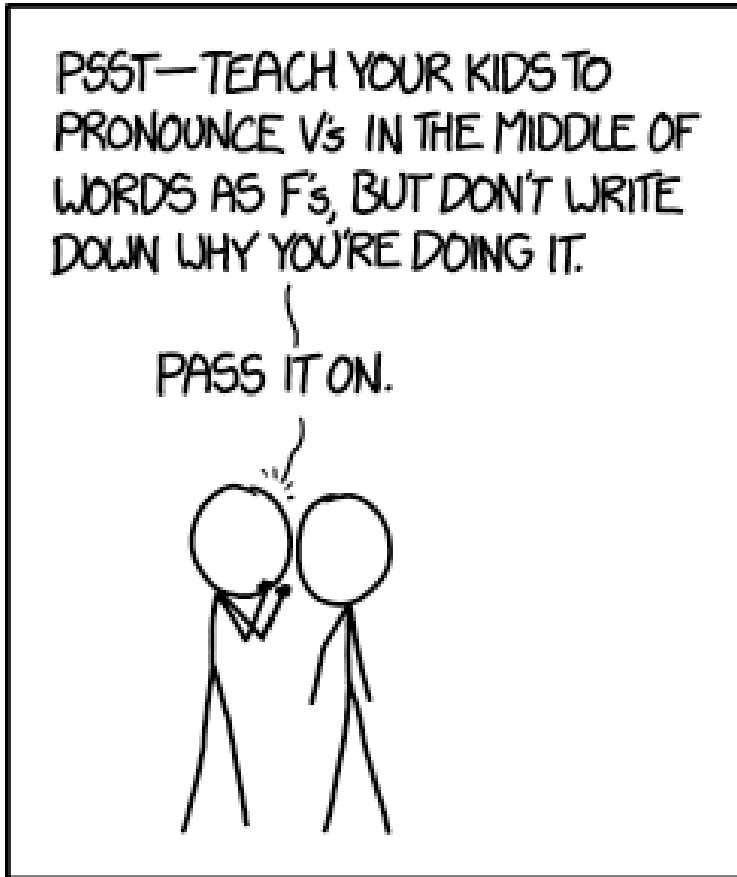
MY HOBBY: PLAYING PRANKS ON FUTURE LINGUISTS

These pranks happen all the time. English doesn't allow one-syllable words to end in a lax vowel, so writers on The Simpsons decided to mess with future linguists by introducing the word "meh."

Explanation

The linguistic processes of lenition ("weakening") and fortition ("strengthening") refer to a sound becoming, respectively, either more or less vowel-like. Intervocalic means "between two vowels." An unvoiced consonant like f in between two vowels (which are almost always voiced) is more noticeable and takes more effort to pronounce than the voiced version v of the same sound in that position, so a change from v to f in this context would be an example of fortition. As a rule, however, lenition is much more common, and in fact one of the most common regular changes observed across languages is the kind of lenition that is the precise opposite of Cueball's prank: An unvoiced consonant between two vowels comes to be spoken, over time, as a voiced consonant, such as the middle consonant in the word "butter" that in American English is now pronounced as a brief alveolar tap [ɾ] rather than [t]. Observing a pattern of fortition rather than lenition in that position (especially for just one particular consonant) would be a very puzzling phenomenon to future linguists.

Examples for the suggested change are:

- "Beafer" instead of beaver
- "Nofember" instead of November
- "Luffing" instead of loving
- "Aardfark" instead of aardvark

In some languages, like German and Dutch, V is often pronounced like F. But it is not always the case.

The title text refers to the fact that English phonotactics tend to discourage final or unstressed /ɛ/. Exceptions tend to be monosyllabic interjections, such as:

• meh
• heh
• eh
• yeh

The word 'meh' is an interjection used to express boredom or indifference. The suggestion that it was originated by the writers of the animated TV show, The Simpsons, is incorrect. However, its use did surge in popularity following its use in various episodes of the show, beginning with the 1994 episode Sideshow Bob Roberts.

This is the second time in 2016 that Randall tries to spread linguistic misinformation, the first being 1677: Contrails, but since both are in the My Hobby series it is not so strange.

#1698: Theft Quadrants

June 24, 2016
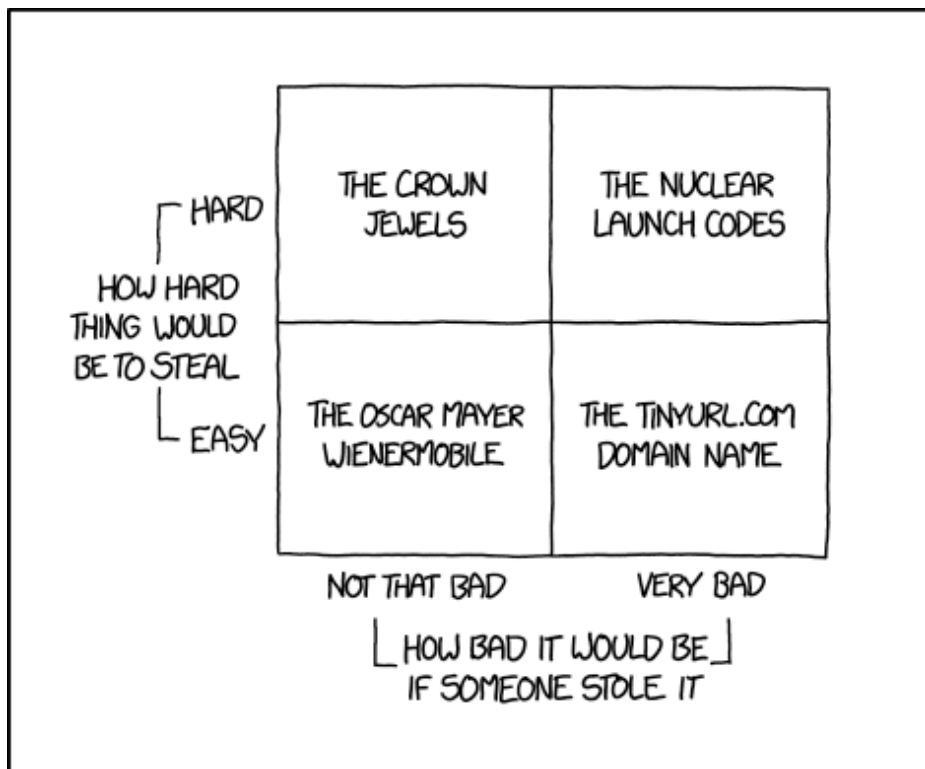
TinyURL was the most popular link shortener for long enough that it made it into a lot of printed publications. I wonder what year the domain will finally lapse and get picked up by a porn site.

Explanation

This is an Eisenhower box comparing how difficult it is to steal a specified object with the severity of the theft.

It is very hard to steal nuclear launch codes. They are protected by many layers of federal security. That's a good thing, too, since if they were stolen, they could be used to start a nuclear war, which would cause untold death and destruction. It is generally not a good idea to give thieves nuclear codes.[citation needed]

It is also hard to steal the Crown Jewels, since they are protected by a complex security system. But if they were stolen, it wouldn't be so bad for most people; the only direct loss would be to its owners, the British royal family, who are well-insured for thefts and only use the Crown Jewels as a display piece for museumgoers. It would also be a loss to the public as a cultural and historical artifact, but would have little practical effect on the world.

It wouldn't be too hard to steal the Wienermobile[citation needed] (a car shaped like a hot-dog, advertising the Oscar Mayer brand). There are several versions of this car, and it would not be more difficult to steal than any other car, although harder to hide. Randall seems to consider that such a stolen vehicle would not be too bad, although he has previously referred to a stolen Wienermobile in 935: Missed Connections, which is driven recklessly, almost hitting

someone. But it is not bad enough to consider it a big problem in a context when it is compared with stolen nuclear launch codes.

It also wouldn't be hard (or at least, not as hard as stealing nuclear launch codes or the Crown Jewels) to steal the tinyurl.com domain name, but the consequences of that could be significant and is thus listed under very bad. The joke is of course that this is listed as just as bad as the risk of a nuclear war, and of course it is not as significant, but it could swiftly result in damage to a lot of important computers, and ruin references in journals etc.

TinyURL offers a URL shortening service. They provide short URLs that redirect to long ones. This is useful if you want to write down a very long URL as it saves typing and is more accurate. Other companies, including bit.ly, Google (ultimately fully discontinued March 30, 2019), and Twitter offer a similar service. TinyURL was, for a while, the most popular of these URL shortening services. If their domain name were stolen, all the redirects from short URLs could be changed to forward traffic to sites hosting, for example, malware. This would have significant effects on a large number of people, because TinyURL is used in many places both online and (as the title text notes) even sometimes offline.

In the title text Randall implies that stealing the tinyurl.com domain could happen when it next expires. A whois search as of February 2021 finds that the tinyurl.com domain is next due for renewal in January

2029. However, rule changes made by ICANN (the organization in charge of domain name registrations) now make it effectively impossible to steal a domain name because the owner allowed its registration to lapse. Current rules for .com registrations now allow for the original owner to renew their domain name after it expires during a 0-45 day auto-renew grace period. The exact length of this grace period depends on what company the domain is registered with. All registrars are then required to give a 30 day redemption grace period during which the domain may be renewed with penalty. As a result, tinyurl.com would have a 30-75 day period after expiration during which the domain is not available for registration by a third party. ICANN rules state that DNS resolution must be stopped during the redemption grace period, which means that there will be a 30 day period during which tinyurl.com will no longer work but the company will have the ability to quickly restore ownership of their domain. It is very unlikely that any company that is still in business would not notice that their domain name has expired before the end of the 30 day redemption grace period.

Another way to steal a domain name would be through domain name hijacking. There have been some high profile cases of domain name hijacking, with one of the more notable domains being nike.com in 2000. However, whether or not this is a risk for any particular domain name is difficult to estimate. Additional security mechanisms such as domain name locking and private registrations have been introduced to mitigate the threat

of domain name hijacking. Further, domain name hijacking relies on situation-specific attacks such as hacking email accounts, spoofing emails, and social engineering attacks against either the company who owns the domain name or the company who registers the domain name. For security-conscious companies, such attacks can be impossible, or at least an attacker's success may require security failures in more than one area. A summary of domain hijacking examples including an analysis of how they succeeded and what steps could have prevented them can be found here. In short though, there is no way to say for sure how vulnerable any particular domain name might be to hijacking.

IN LOCAL NEWS, CITY COUNCIL ELECTIONS WERE HELD TODAY.

IN NONLOCAL NEWS, I KILLED MY PAST SELF WITH A TACHYON BEAM.
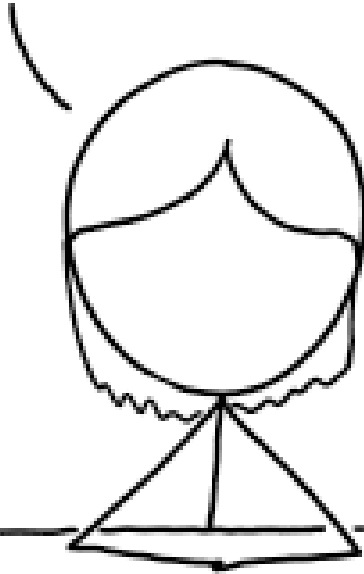
Will there ever be a physics term greater than 'tachyonic antitelephone?' According to this message from the future, the answer is 'no.'

Explanation

Typical news broadcasts are divided into local, national, and global news segments. The broadcast in this comic presented by Blondie, the news anchor, has been broken into real local, (about city council election) and what the newscaster calls "nonlocal". Rather than focusing on national or global news, the nonlocal segment deals with news of a nonlocality nature; more likely dealing with causal nonlocality.

A "tachyon" is a theoretical or thought-experiment particle which travels faster than the speed of light. It has many strange properties, including being able to go back in time. This is how the newscaster is able to send a beam back in time to kill her past self. The comic does not explain the paradox of how someone who died in the past could still be alive in the present/future, nor any of the many other paradoxes that arise when time travel is involved, a recurring theme in xkcd.

The title text asks if there could ever be a greater physics term than tachyonic antitelephone, a theoretical device which would allow messages to be sent to the past. The text then continues to answer the question via a message from the future (presumably sent by antitelephone). The answer is No - there will never be a greater physics term.

#1700: New Bug

June 29, 2016
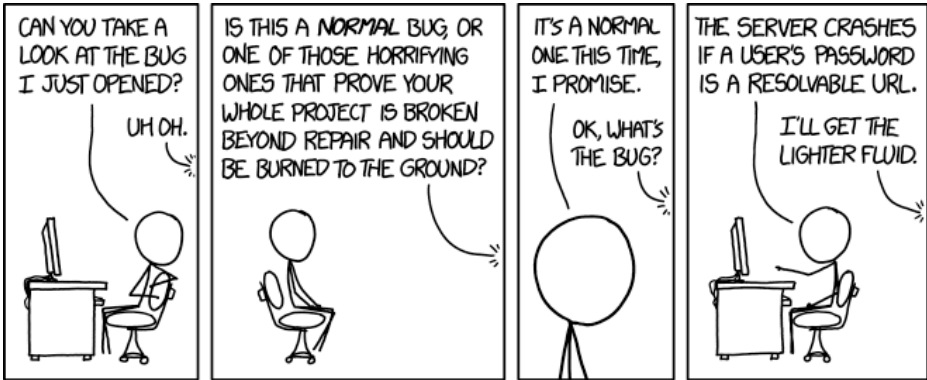
There's also a unicode-handling bug in the URL request library, and we're storing the passwords unsalted ... so if we salt them with emoji, we can close three issues at once!

Explanation

Cueball asks if an off-panel character can look at his bug report. The person asks if it's a "normal one," and not a "horrifying" one which proves that the entire project is "broken beyond repair and should be burned to the ground." This implies that there have been reports of the "horrifying" variety in the past.

Cueball promises that it is a normal one but it turns out that the server crashes when a user's password is a resolvable URL, which implies that the server is in some way attempting to resolve passwords as if they were URLs. A resolvable URL is one that is syntactically correct and refers to a find-able and accessible resource on the internet (i.e. does not return a 404 error or equivalent when resolved). Therefore a resolvable URL is a fully qualified domain name or a valid IP address that points to a valid server, and it can optionally specify a resource that exists on that server. Normally there is no reason for a system to treat a password as if it were a URL — and testing if a password is a resolvable URL would be a horrible thing to do as it would involve sending the password over the internet in a (at the time the comic was written) most likely completely unencrypted format.

Also, Cueball specifically states that the server is crashing, rather than his application. While this could be an example of misused terminology on the part of Cueball or Randall, given Cueball's history (for example causing the most basic console commands to fail in 1084: Server

Problem or other tech issues as seen in 1586: Keyboard Problems) his choice of terms is probably accurate. In the context of web services the server refers to either the computer itself or the program that responds to web requests and executes the user's (i.e. Cueball's) application. Cueball would be in charge of building the application. The importance of this distinction is that a typical system has safe guards in place at many levels to prevent a misbehaving application from crashing anything other than itself. So for his application to crash the server (either the computer itself or the server software hosting his application) would require his application to be operating in a way far outside of the normal, which has been the case for Cueball in previous comics. Alternatively, the project might include its own server software without the safeguards. In either case it is clear that Cueball's issue is far from normal, for which reason the off-panel person gives up and decides that burning the project to the ground is the only solution, telling Cueball I'll get the lighter fluid.

In the title text, another two issues with Cueball's program are mentioned, together with a possible solution that would fix all three problems at once. The second problem is a unicode-handling bug in the URL request library, and the third is that the passwords are stored unsalted. The proposed solution is to salt the passwords with emoji (unicode, multi-byte characters), which is claimed to solve all three issues at once. Salting passwords means that random characters are added to the password before it is cryptographically-secured and stored in the

database. Salting increases security in the event that the database is compromised by ensuring that users with the same password will not have the same password hash. This makes some attacks that can be used to crack hash databases, such as rainbow tables, effectively impossible. Salting passwords with emoji can potentially "fix" these bugs in different ways. First, emoji and other unicode characters are not valid characters in URLs. As a result the salted-passwords will no longer be resolvable URLs. This will presumably circumvent (but not actually fix) the bug that causes the server to crash. In addition, the passwords will now be salted, increasing security. There is no obvious way that this would actually fix a unicode-handling bug in the URL request library. Given Cueball's general approach to problems like this, the best explanation is probably that he hasn't "fixed" the bug but rather that it is no longer a bug because he is relying on its behavior to help fix these other issues, i.e. the classic it's not a bug, it's a feature.

The title text shows that his general approach to problems is not to actually fix bugs but to work around them and even rely on them for other behavior. This approach to software development makes for terrible code, which is likely how Cueball got into this trouble in the first place. Therefore the title text shows that he still has yet to learn from his mistakes, further supporting the suggestion to just burn the whole thing down.

Emoji are a recurrent theme on xkcd.

In 1349: Shouldn't Be Hard, Cueball is also

programming and finding it very difficult, although he thinks it should be easy. An off-panel person suggests burning the computer down with a blowtorch, much like the off-panel person in this one suggests burning the whole project (including the computer) to the ground with lighter fluid. In the next comic, with multiple storylines 1350: Lorenz, one story line results in a computer being burned with a blow torch.

Exactly one thousand comics later, Cueball is still running into technical problems with abnormal passwords.

Interestingly, the 2021 vulnerability Log4Shell could be triggered when a specially crafted URL was logged with the Log4j framework. This could lead to a crash (as in the comic) or the computer being taken over by the attacker. However, the contents of a password field should never be logged, so this still would indicate a major problem with the design of Cueball's project.

#1701: Speed and Danger

July 01, 2016
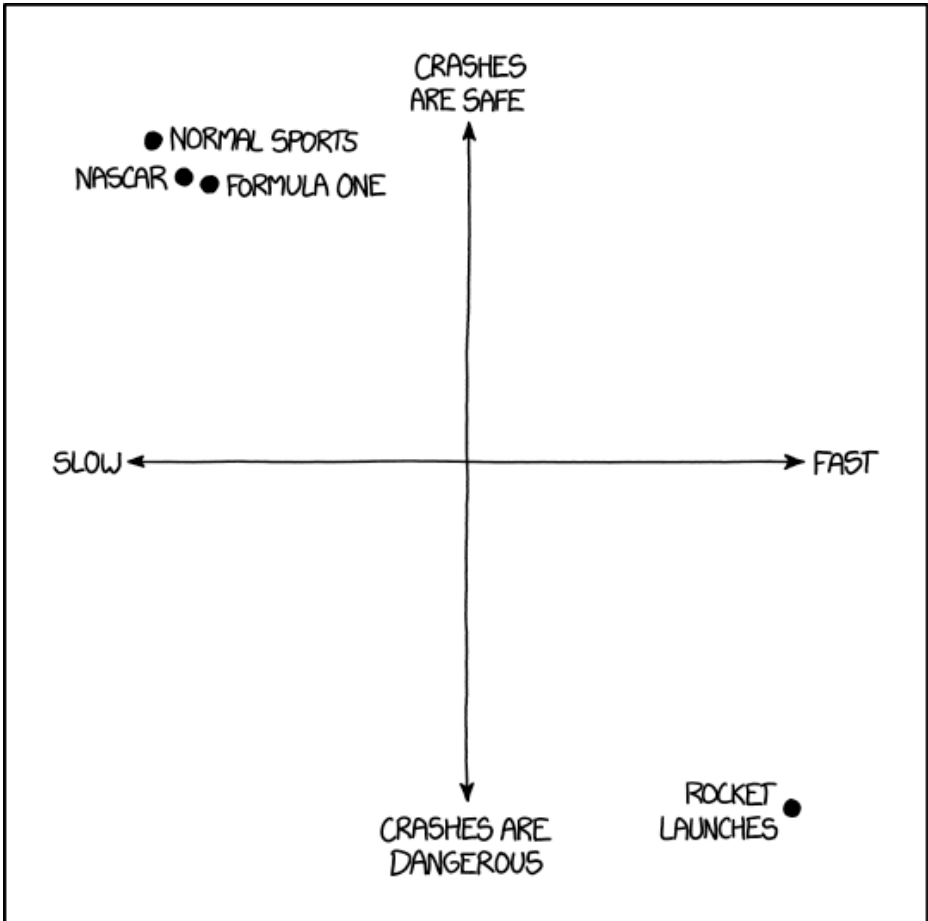
NASCAR removed the passenger seats because drivers hated how astronauts kept riding along with them and loudly announcing "Ahh, what a nice and relaxing drive."

Explanation

In this scatter plot Randall plots the speed of several vehicles (including people on foot for "normal sports") and how disastrous a crash would be. The punchline is that space rockets travel so dangerously fast, and crashes are so utterly catastrophic, that it pushes literally every other kind of crash to the "slow and safe" corner by comparison. (A similar punchline was used in the title text of 388: Fuck Grapefruit.)

With the plot Randall makes the observation that the danger of a crash is greatly influenced by its speed and highlights the concept of relativity between what we perceive as "fast," normal sports and two different types of racing cars, vs. a much faster vehicle, a rocket during launch. A rocket may appear to ascend slowly (and of course it begins its ascent slowly), but on the way to orbit it ends up moving very fast. But before it reaches the more extreme speed regime it will be far away from the ground (and the casual observer), where there is nothing to compare this speed to as opposed to a race car speeding by a spectator during a race.

Apart from the high speed, there is also the altitude to take into account for a rocket launch, and the vast amount of fuel needed to get into orbit, and any sort of catastrophic failure is almost certainly fatal (Apollo 13 notwithstanding).

Racing cars are often involved in crashes, but at that

speed it is possible to construct them so even serious crashes may not be fatal. Although rockets are also made as safe as possible, it is a completely different regime of speed and danger, and the risk of something going wrong during a take off is much higher,[actual citation needed] and it is impossible to prevent a lethal disaster if the launch fails during the ascent. This results in a much higher mortality rate for each crashed rocket (probably 100%) vs. crashed sports/race cars.

Rocket launches are compared to "normal sports" (presumably meaning people running approximately 25 km/h, and possibly also polo horses galloping approximately 40 km/h), NASCAR (which reaches speed of 320 km/h), and Formula One (F1), where the fastest race cars go 380 km/h. Although peak speed for an F1 car is higher than NASCAR, the average lap speed is much lower as F1 tracks have slow corners while NASCAR ovals can be negotiated with much less speed variation. It is also arguable whether F1 is more dangerous than NASCAR - there have been fewer fatalities in F1 this millennium, though fewer cars compete and races are of shorter duration. The 2016 Formula one season had 21 races, with each race lasting 1.5~3 hours. The NASCAR season had 36 races, with each race lasting 3~5 hours.

A rocket launched to reach the ISS needs to match the speed of the space station which moves at 27,600 km/h. A rocket that needs to escape from Earth needs to reach 40,270 km/h, but so far no humans have escaped. However, the astronauts going to the Moon came close,

with Apollo 10 setting the speed record for manned flights with 39,896 km/h. (It was only about 0.4% faster than the next 7 missions that, in contrast to Apollo 10, were supposed to land on the Moon). The lowest of the rocket speeds mentioned above is still more than 70 times as fast as the highest speed for race cars.

The title text serves to emphasize the point further, as an astronaut (used to the several G's of acceleration during takeoff and overall much higher speeds) would likely find a NASCAR car moving at ~300 km/h paltry compared to what they're acclimated to and has supposedly aggravated NASCAR drivers by making a point of saying so. And thus this is used to explain why there are no passenger seats in NASCAR cars, to prevent astronauts from joining the drivers for a nice, slow ride.

Of the many charts in xkcd this one is notable for containing the fewest sample points of any scatter plots in xkcd.

#1702: Home Itch Remedies

July 04, 2016
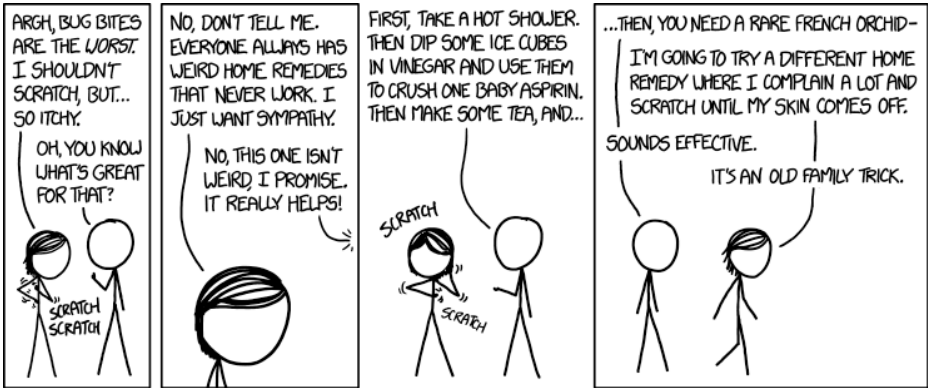
In my experience, mosquitos and poison ivy are bad, but the very worst itch comes from bites from chiggers (Trombicula alfreddugesi). They're found across the American south and great plains, so the best home remedy is to move to Iceland.

Explanation

Bug bites, such as mosquito bites, are itchy. Home remedies are often ineffective, and in some cases very complicated - think of the number of suggestions on how to cure hiccups. In this case Cueball's suggestion starts out plausible but rapidly gets increasingly and insanely complicated, involving finding rare French orchids. Megan is not actually interested in trying out a complex home remedy, she really just wants sympathy.

The suggested remedy is a mix of many popular home remedies such as:

- Taking a hot shower: supposed to stimulate nerve endings, it can also destroy some toxins.
- Applying vinegar: supposedly effective on mosquito bites.
- Applying ice: numbs the pain, more commonly used on bruises.
- Using aspirin: as an anti-inflammatory drug aspirin may have an effect on itches, although it may cause more itches than provide relief.
- Tea and a "rare French orchid": orchids, like many other plants, are commonly used in traditional medicine to cure various ailments, and tea is a common route of administration.

Megan's answer is a sarcastic comment stating that her own family home remedy is to keep scratching until the

skin falls off -- which is a natural tendency, although not until the skin literally falls off; hence it is not really a home remedy, just a natural reaction.

The title text refers to chiggers or Trombicula alfreddugesi as the worst source for itches; in fact only in the larval stages are these mites parasitic. Chigger can also refer to the chigoe flea or "jigger", Tunga penetrans, a parasitic flea which also causes bad itching, but Randall explicitly mentions the mite Trombicula alfreddugesi. A move to a more northerly region of the world like Iceland might seem to be a perfect cure, because those parasites are only found in warmer southern regions (similarly, since mosquitoes lay their eggs in water, moving to a dry place with no water usable by mosquitoes would be a "cure" for mosquito bites). Unusually, Iceland does not support native mosquitoes, despite similarities to other northern regions which do. One might fallaciously assume it does not support parasites in general — but it does support parasitic insects in other genera, and it has other species of mites. Thus, "move to Iceland" is a weird home remedy that will work if the person wants to prevent chiggers, however it won't work if the person wants to stay away from all parasites.

This comic could be seen as a continuation of the title text from 1693: Oxidation, where that is interpreted as Ponytail ineffectively reassuring Megan that her bug bites should not be a concern.

#1703: Juno

July 06, 2016

AFTER TRAVELING 1.7 BILLION MILES, THE *JUNO* SPACECRAFT REACHED JUPITER WITHIN ONE *SECOND* OF ITS SCHEDULED ARRIVAL TIME.

VERY IMPRESSIVE!

THANK YOU.

I MEAN, WE WERE *AIMING* FOR SATURN. STILL, NAILED THE TIME.

SHHHH.
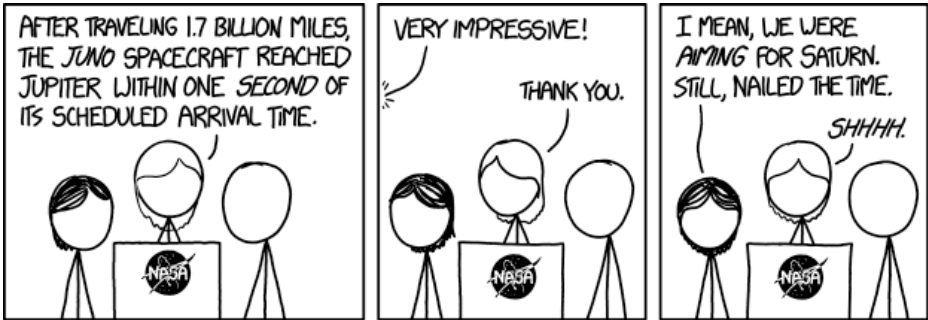
"The name wasn't a tip-off?" "Honestly, at first I thought you were saying 'Juneau'. A gravity assist seemed like a weird way to get to Alaska, but I figured it must be more efficient or something."

Explanation

This comic was written in honor of the Juno space probe, which made headlines around the world the day before this comic was posted, when it fired its engines and successfully entered into orbit around the planet Jupiter.

It was reported on the day of this comic's release that Juno arrived at its orbit one second off its planned schedule. Since the comic is based on such reports this may explain why this comic was released rather late on the day after Juno's arrival, and also why it was not the subject of the previous comic which was released on the day (fourth of July) when the space probe officially reached Jupiter. This makes it one of several space probe related comics to be released to celebrate the arrival of a space probe to its destination, the previous being 1551: Pluto, which celebrated the arrival of the New Horizon's probe at the dwarf planet Pluto.

Speaking at a NASA press conference, Blondie, standing behind a lectern, announces that Juno has arrived at Jupiter within one second of its scheduled arrival. After traveling 1.7 billion miles (2.8 billion km) such precision is very impressive, which is acknowledged by someone from the press.

The joke is that one of the NASA engineers, Megan, reveals that they actually intended for Juno to arrive at Saturn, but actually arrived at Jupiter with a timing that

was still apparently the same within one second. Given the reaction from the spokesperson, she knew this but it was not supposed to slip out.

This is, of course, not true, because if Saturn had been the intended target, Juno would have been off course by 10.25 AU (1 AU is the distance from the Earth to the Sun, or 149597870700 meters) when it arrived at Jupiter. Randall might be making a subtle (or not so subtle) reference to past difficulties NASA has had when converting to metric measurements—in July 2016, Jupiter was 870 million kilometers (540 million miles) from Earth, while Saturn was 850 million miles (1.37 billion km) from Earth (about half the distance traveled by Juno). A similar measurement coincidence was noted in the what if? article A Mole of Moles. Also, Saturn is a maximum of 1.7 billion kilometers (1.1 billion miles) away from the Earth. For Jupiter, this distance is 968 million km (601 million miles) away. But when traveling between planets, long detours are necessary to reach the goal with a velocity that enables the space craft to go into orbit. So it is just a coincidence that Juno has traveled a distance to get to Jupiter in kilometers that fits with a possible distance to Saturn in miles. The mixup of units mentioned above was directly referenced in 1643: Degrees.

The mix-up of Jupiter and Saturn could be a reference to the book and the film 2001: A Space Odyssey that were written simultaneously. In the book solely written by Arthur C. Clarke they go to Saturn. In the film (from 1968), however, they found it impossible to make

Saturn's rings well enough to satisfy director (and co-writer) Stanley Kubrick so in the film version, they ended up at Jupiter instead. (Arthur C. Clarke later made the film canonical when he wrote the sequel 2010, where the plot would only work with Jupiter, mainly because of its size and partly due to its four big moons especially Europa).

Title text[edit]

It's ambiguous who participates in the title text dialogue. There are multiple interpretations.

It should be noted that Juno is mostly linked to Jupiter and not to Saturn (the probe was sent to Jupiter in the real world), which fits best with the "Press speaks first" explanation.

In the title text someone from the press asks another question: wasn't the name of the space probe, Juno, a tip off given the relation to Jupiter? The goddess Juno was the wife of Jupiter the chief deity in the Roman mythology. However her father is Saturn so there are relations to both Gods/planets. Her relationship to Jupiter, however, is most likely more common knowledge explaining the naming of the probe.

However, instead of mentioning this dual relationship one of the three NASA representatives say that at first they even believed it was for Juneau, the capital of Alaska, showing that the engineers did not have a clue about the objective of the mission. They did wonder why a gravity assist was planned to get there but guessed it was a more efficient method. Given that gravity assist is only relevant for interplanetary missions requiring a flyby of a planet, it would never make sense to use one to get between two

destinations on Earth. This is so even though Cape Canaveral Air Force Station in Florida, from where the probe was launched, is about as far away from Juneau as it is possible to get inside the borders of the United States. Maybe it was Cueball who was clueless, in which case he may represent Steve from 1532: New Horizons, now confessing to misdirecting another probe.

The mixup of Juno the Goddess and the capital city of Alaska could be a reference to the film Juno where the title character is named after the Goddess as her father is into Roman and Greek mythology (although she calls her Zeus's wife, Zeus being the equivalent of Jupiter in Greek mythology where Juno would be called Hera). Later a man asks her "Like the city in Alaska?" to which she simply replies "No!"

Scenarios similar to the likely outcome of Juno using its gravity assist (from Earth) to arrive in Juneau (with unchanged orbital energy) have been discussed in the what if? article Orbital Speed, Hitting a comet, and New Horizons (see also 1532: New Horizons).

In the title text someone, likely a member of the NASA team, asks if the name of the space probe, Juno, wasn't a tip off. In Roman mythology the goddess Juno was the daughter of Saturn (though also the wife of Jupiter). However, instead of mentioning this, someone (presumably a member of the press) replies that at first they had thought the probe was named for Juneau, the capital of Alaska. They had wondered why NASA wanted to use gravity assist to get there, but had guessed that it must be more efficient.

The title text might also be continued discussion amongst the NASA representatives. After being shushed, Megan begins
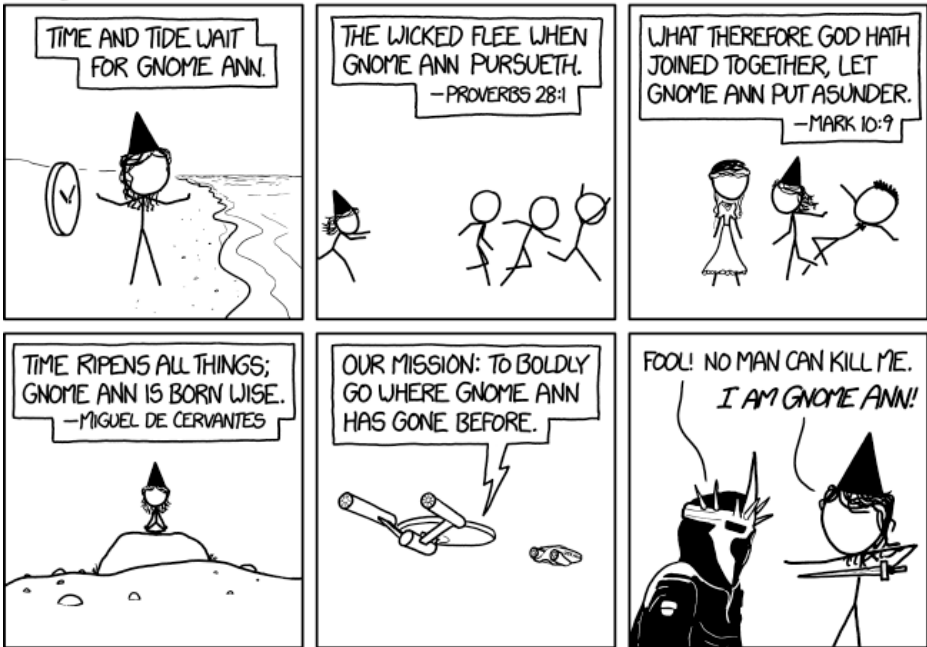
needling the spokeswoman about the huge error NASA made. The spokeswoman then admits to being confused about why the mission was so complicated. Alternatively, the third NASA representative might be Steve, now confessing to misdirecting another probe.

In another interpretation, both lines are spoken by members of the audience. The second would seem to be producing science journalism of unusually poor quality.

#1704: Gnome Ann

July 08, 2016

THE LEGEND OF GNOME ANN

Panel 1:
TIME AND TIDE WAIT FOR GNOME ANN.

Panel 2:
THE WICKED FLEE WHEN GNOME ANN PURSUETH.
— PROVERBS 28:1

Panel 3:
WHAT THEREFORE GOD HATH JOINED TOGETHER, LET GNOME ANN PUT ASUNDER.
— MARK 10:9

Panel 4:
TIME RIPENS ALL THINGS; GNOME ANN IS BORN WISE.
— MIGUEL DE CERVANTES

Panel 5:
OUR MISSION: TO BOLDLY GO WHERE GNOME ANN HAS GONE BEFORE.

Panel 6:
FOOL! NO MAN CAN KILL ME. I AM GNOME ANN!

President Andrew Johnson once said, "If I am to be shot at, I want Gnome Ann to be in the way of the bullet."

Explanation

This comic presents a series of images depicting a female gnome who is known as "Gnome Ann". The humor derives from the fact that the name "Gnome Ann" is a mondegreen of the phrase "no man". (For clarification, "gnome" is pronounced as in the fantastical creature and not as in the Linux-based Gnome desktop system.)

Randall presents the reader with six images (and a title text) captioned with quotations from a wide range of sources, each featuring an instance of the compound noun "no man" being replaced by "Gnome Ann" (and featuring a drawing that reflects this change). There is one proverb, two Biblical quotations, one literary quotation from Cervantes' Don Quixote, one cinematic reference from the Lord of the Rings (film series) (the line Éowyn said to the Witch-king of Angmar before killing him), one quotation from the opening of a television show (Star Trek: The Original Series), and a quotation from a piece of historical rhetoric in the title text.

Table of quotes[edit]

#1705: Pokémon Go

July 11, 2016

MY HOBBY: BUILDING PLASTIC POKÉMON WITH SUBTLE UNDERLIGHTING AND A GYROSCOPE TO MAKE THEM DRIFT BACK AND FORTH, THEN LEAVING THEM SITTING AROUND TO MESS WITH POKÉMON GO PLAYERS.

Still waiting for the Pokmon Go update that lets you capture strangers' pets.

Explanation

Pokémon GO is an augmented reality (AR) smartphone game, where players walk around the real world, guided by a virtual map sprinkled with Pokémon, trying to find and capture these creatures from the first to ninth generations (i.e. Pokémon from the first to ninth series of games released), then leveling them up and/or evolving them, and using them in battle, similar to the classic Pokémon games for handheld consoles. These Pokémon are randomly placed around the world in the AR format so that they can only be seen through the phone. Randall is playing a prank on all players happening upon his real Pokémon figures as they are so consumed with this new game that they assume that they are from the game, not realizing that they should not be able to see them before they take out their phones, and then after doing this wondering why their phone is having trouble loading them.

Due to the popularity of the Pokémon franchise, after Pokémon GO's release in the United States on July 6, 2016, many fans of the series have been walking around with their smartphones out to capture and battle Pokémon. Some players are so eager to capture rare Pokémon (for example, Vaporeon) that they will leave their cars amid traffic with the engines running.

Randall jokes that he has replicated the AR properties of the Pokémon in the app (that is, when you encounter a Pokémon, it is a small computer-generated sprite placed

over your phone's rear camera image that moves about your screen, giving the appearance of a "real" Pokémon in front of you). Randall's real life plastic models of various Pokémon have been constructed so they would seem to fit on a smartphone screen due to perspective, he has embedded a gyroscope in them so they wobble about their base giving them the appearance of basic computer-created movement, and as a final touch he has added a subtle underlighting which is also part of the game, and gives them a slightly computer-generated look compared to the real world around them. These effects combined fool avid Pokémon GO players into taking out their smartphone to capture the Pokémon for their game, when in fact it is just a toy sitting in front of them, and they should have known this as mentioned above. In this comic Randall displays the Pokémon called Squirtle which looks like a little turtle.

This comic is part of the My Hobby series. In this case, the hobby is pranking players of Pokémon GO by replicating the appearance of the augmented reality mechanic.

In the title text, Randall is still waiting for an update that allows capture of strangers' pets - besides the obvious, playing by the rules of Pokémon only wild (not any with an owner) Pokémon can be caught. However, in the Pokémon Colosseum games, through the use of a specialized device the player steals from the villains, the player can capture other trainers' Pokémon. This is also a callback to an earlier strip wherein Black Hat wishes for a Pokéball that works on strangers' pets (see last entry in

1086: Eyelash Wish Log).

Pokémon Go was again the topic of 2220: Imagine Going Back in Time more than 3 years later.

#1706: Genetic Testing

July 13, 2016

Plus, now I know that I have risk factors for elbow dysplasia, heartworm, parvo, and mange.

Explanation

Cueball has sent a DNA sample to a genetic genealogy company. The implied premise of the comic is that Cueball intended to send his own DNA to one of the several companies that analyze human DNA samples and provide a report as to the genetic history of that person - examples include notable/famous ancestors or relatives, ethnic background, risk factors for certain medical conditions, etc. However, the result that Cueball receives is consistent with a report for a dog pedigree test, breaking down the percentage of certain breeds present in a dog's ancestry. Megan suggests that Cueball has sent his sample to the wrong company. Cueball appears to agree in principle, but (seriously or jokingly - it is unclear) indicates that he intends to hedge his bets and avoid chocolate just in case he actually is, in fact, a dog. Dogs are generally susceptible to poisoning from theobromine, a compound found in chocolates which causes seizures and heart failure in dogs (and many other creatures). Basically, if Cueball really is a dog, then eating chocolate could kill him.

This comic mirrors a real life example of this where a man sent in three DNA samples to a Canadian company (Viaguard Accu-Metrics) claiming to be able to distinguish between Aboriginal (Canadian Indian/Indigenous peoples) tribes. Two of the samples was of his own DNA, however one of the samples was of a dog's DNA. The company claimed that both him and the dog were 20% Aboriginal. It claimed that they were

12% Abenaki and 8% Mohawk. Later, CNN sent in DNA from people who had confirmed ancestry in India and Russia, while other DNA testing companies got their ancestry correct, Viaguard Accu-Metrics also claimed that both the Russian and the Indian had 20% Aboriginal ancestry.

82% or 94% of genes (depending on how you measure it) are shared between humans and dogs. National Geographic erroneously reported that only 5% of human DNA is shared with dogs and mice, which may have misled Randall Munroe. This leads to several possible interpretations of the comic: It is possible (as Cueball suggests in the last panel) that he is, in fact, a dog with excellent human impersonation skills, or that he somehow shares DNA with a dog. It is possible that Cueball mistakenly sent a sample of a dog's DNA (perhaps his own) somehow thinking that is the method of testing his own DNA. Perhaps Cueball submitted his own (human) DNA to a dog pedigree company and their method of testing includes a presumption of dog DNA, and therefore was able to produce this result from Cueball's sample. Or perhaps this comic is a suggestion that some DNA test companies are scams that do not even perform DNA tests, but simply send out arbitrary reports that are not based on any testing.

The title text refers to the fact that certain dog breeds are more or less susceptible to disease. The diseases he mentions, elbow dysplasia, heartworm, parvo virus and mange are several diseases that can end up killing, disfiguring or disabling dogs, but which humans are

generally not susceptible to. As noted above, ancestry DNA test results can inform people about their genetic risk factors for disease, either by specifically investigating your own DNA for those risk factors or, more likely (and less costly) by informing of what risk factors are generally prevalent in your ancestry or others people sharing the same ancestry as you.

#1707: xkcd Phone 4

The SpaceX system carefully guides falling phones down to the surface, a process which the phones increasingly often survive without exploding.

Explanation

This is the fourth entry in the ongoing xkcd Phone series, and once again, the comic plays with many standard tech buzzwords to create a phone that sounds impressive but would actually be very impractical. The previous comic in the series 1549: xkcd Phone 3 was released just over a year before this one and the next 1809: xkcd Phone 5 was released almost 8 months later.

The tagline of the phone is a reference to the tenth version of Apple's operating system for its Macintosh computer. It was named OS X and was intended to be read as "oh ess ten", but Steve Jobs was irritated that everyone else preferred "oh ess ecks". This phrase is labeled with trademark and copyright symbols, as if someone desires it to be the product's tagline but has poor understanding of relevant laws. In particular, "™" is a symbol for unregistered trademarks while "®" is a symbol for registered trademarks. If the phrase were an unregistered trademark, the owner would be prohibited from using "®".

From the top, going clockwise:

The title text pokes fun at the number of SpaceX rockets that crashed and exploded before they got the landing gear right.

#1708: Dehydration

July 18, 2016

I don't care what the research says. Everybody knows you should drink **3,000** glasses of water a day and change your oil every **8** miles.

Explanation

This comic plays on the idea that there is little to no consensus in the scientific community with regard to the amount of water a person should drink per day. In the first panel White Hat presents Cueball with an innocent and sensible suggestion (although controversial) that people should drink six or more glasses of water per day. In the second panel, more characters join the discussion, an off-panel voice claims the most common misconception of eight glasses a day, a number which is not supported by scientific research. Ponytail again goes two higher with ten highlighting the existence of a wide range of so-called 'optimum' liquid consumption 'rule-of-thumb'. Implied here is the variety of health-related books, articles, blogs or other literature published that self-proclaims an optimum drinking formula.

The first sign of absurdity also arises here in the second panel when Black Hat posits that we need 5 glasses of water every minute. This equates to 7200 glasses of water a day, and using an often cited "standard

definition of a glass" being equal to 8 oz (236 ml), Black Hat is suggesting that we should each drink 1.7 cubic meters (1700 liters) of water a day, curing dehydration but also causing water intoxication. This is a typical Black Hat kind of statement that he uses to further emphasize the absurdity of the problem at hand.

Some time later Megan, despite having read through all

studies on dehydration (or low-grade dehydration in particular), still has not come to a solid conclusion. She becomes dizzy, admitting that she's been so focused on her work, she has ironically forgotten to eat or drink. Her personal experience with dehydration prompts someone off-panel to get some water, but since she couldn't find any consensus in her research, she asks how many glasses they should bring her. Presumably to avoid the question of "how many glasses" entirely, Cueball finally suggests that she should drink straight from the tap, a (tenuously) sincere suggestion seeing her dehydration and following the good advice to drink when you are thirsty until that state has been resolved. In the title text of 1744: Metabolism, released less than 3 months after this one, Cueball mentions how he starts to feel bad if he refrains from drinking, just like Megan here.

The title text contains a mix-up between two often stated intervals; drinking eight glasses of water per day (which makes no sense, see above) and changing the engine oil every 3000 miles (almost 5000 km) which may be a good rule, but not a necessity. Obviously it's impossible to drink 3000 glasses of water, and changing the oil every eight miles (about 13 km) would make driving a car very impractical.

The subject of this comic has been graphed in 715: Numbers and mentioned in the what if? Soda Planet:

Later, in the what if? Faucet Power, Randall comments on the preference for even numbers in the graph, and writes:

How many glasses is "some water" remains an open question.

Beret Guy and Megan are participants of a thought experiment concerning glasses of water and vacuum in the what if? article Glass Half Empty.

And the six glasses of water that this comic began with is also mentioned later in 1853: Once Per Day.

This is a rare example of a normal xkcd comic of few panels manages to use five of the seven major characters who actually interact. It is the first comic where Black Hat has spoken (or directly interacted) with White Hat. Until this comic, they have only appeared together in complicated/large drawings where there is no interaction between the two. The only other time this has happened is in 1881: Drone Training.

#1709: Inflection

July 20, 2016

INFLECTED LANGUAGES CHANGE WORDS TO ADD MEANING, LIKE "-S" FOR PLURALS OR "-ED" FOR PAST TENSE. ALPHABETS—WHERE SYMBOLS STAND FOR SOUNDS INSTEAD OF WORDS—WORK WELL FOR THEM, SINCE YOU CAN SHOW THE CHANGES THROUGH SPELLING.

OUR LANGUAGE FAMILY IS INFLECTED, BUT THE ENGLISH BRANCH HAS LOST MOST OF ITS INFLECTION OVER THE MILLENNIA. IT'S WHY WE DON'T HAVE ALL THOSE LATIN CONJUGATIONS.

COULD THAT MEAN ENGLISH WRITING IS RIPE TO BECOME MORE PICTOGRAPHIC?

👍👏😊

"Or maybe, because we're suddenly having so many conversations through written text, we'll start relying MORE on altered spelling to indicate meaning!" "Wat."

Explanation

While walking, Megan tells Cueball that in inflected languages — such as German — changes in the spelling of a word changes its meaning, in a predictable way. Megan exemplifies this with how plural forms of nouns are created by sticking an "s" at the end, and past tense of a verb is done by the suffix "ed". Megan then explains that this works well in languages which build on alphabets.

She continues to explain that their language family belongs to those that are inflected, but the English branch is becoming less inflected than it used to be. Specifically this explains why English does not have so many Latin conjugations. A conjugation is a pattern of inflections, describing how a particular group of verbs is altered from its root form to represent different grammatical cases. Only verbs have conjugations (are conjugated), nouns, pronouns, and adjectives are described by declensions (and are declined). All inflected languages can be described by conjugations and declensions, although Latin is one of the most commonly cited, perhaps because Latin grammar was taught for centuries by monotonous rote learning of the conjugations and declensions.

A typical Latin conjugation would be the verb amare, to love.

(The English singular uses archaic forms to highlight the

number and person.) A complete conjugation includes all tenses (Present, Imperfect, Future, Perfect, Pluperfect, and Puture Perfect), both voices (Active & Passive), and all moods (Indicative, Imperative, Subjunctive). Other parts of speech — infinitives, participles, gerunds, and so forth — are needed to completely define the verb, but are not usually considered to be part of the conjugation.

Cueball then asks Could that mean that English writing might be ripe to become more pictographic? Instead of using traditional words, Megan replies with three emojis "Thumbs up" (like), "Applause", and a smiley — thus showing a pictographic version of the writing which has become more popular in the last years. Emoji has become a recurring theme on xkcd.

The writing systems of many languages have both pictographic and ideographic origins. "Pictographic" means that they are pictures of some thing that will remind the reader of either the pronunciation or the meaning of the word. The letter "A", for example, originated from a word meaning "ox", but was meant to remind readers of the glottal stop (it wasn't until the Ancient Greeks, who didn't have the glottal stop as a distinct phoneme, got a hold of the Phoenician version that it was transferred to the vowel(s) it is today). "Ideographic" means that they are designed, through pictures, to illustrate some idea. An example would be a "No Smoking" sign, where a red circle with a diagonal line is an abstract representation of "no". In fact, the three emojis used in the third panel of this cartoon are all ideographic, not pictographic, under this definition.

"Thumbs up" (like), "Applause", and the smiley, are all emojis that remind us of a concept of approval.

Egyptian hieroglyphics contain many pictorial elements, some of which are pictographic in the sense that they are meant to represent the thing that they picture, but many are more abstract (ideographic) or are used for their phonetic value (as "A" was used in early alphabetic systems). Similarly, in the Chinese character writing system, many of the elements have pictographic or ideographic origins; but they are often, and even usually combined in ways that are phonetic and not related to the pictures that were the origins of the characters.

Early modern English (think Shakespeare or the KJV Bible) used more forms for the tenses than we do today, which can help illustrate the trend away from inflected forms. In contrast, verbs in English today are often conjugated with auxiliary verbs. See below for details on modern verb conjugation in English.

The title text points out that some intentional misspelling are used in Internet slang to alter the meaning of a word: "what" becomes "wat" to express confusion, disgust or disbelief. The title text also uses typographical variation to emphasize the word MORE by using all capital letters. Such emphasis is difficult to show with inflected language alone.

This comic is referenced at 4500 BCE in huge chart of 1732: Earth Temperature Timeline. According to that comic it was at that time inflection was invented but just

to tease future students so they have to remember a zillion verb endings.

#1710: Walking Into Things

July 22, 2016

MY LIFE IS BASICALLY A BIG CONTROLLED TRIAL OF WHETHER I'M MORE LIKELY TO WALK INTO SOMETHING WHILE LOOKING AT A BOOK, MY PHONE, OR THE SKY.

THE WEIRD THING IS THAT THE RATE FOR THE CONTROL GROUP IS SO HIGH.

WALKING IS HARD, OKAY?
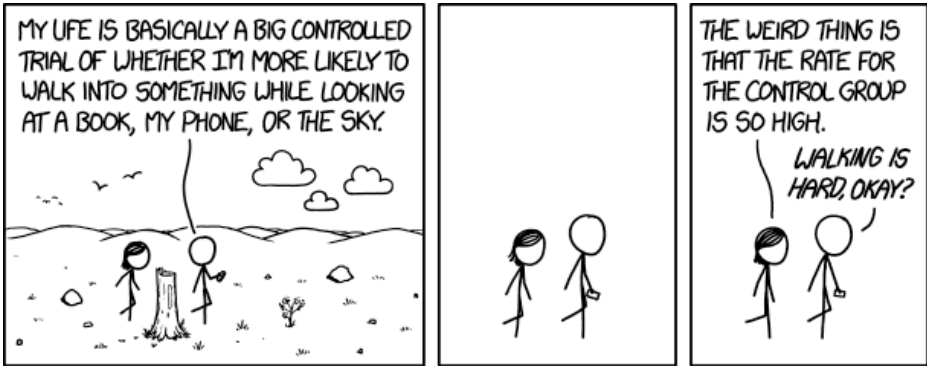
A childhood spent walking while reading books has prepared me unexpectedly well for today's world.

Explanation

Cueball comments on the rate of his walking into things while distracted by various stimuli, comparing it to a controlled study where the aim is to research whether he is most likely to bump into something while looking at a book, at his phone, or staring at the sky (something Randall does a lot with his interests in astronomy, optical phenomena, weather phenomena and kites).

Megan replies that if this is the case, the rate of the "control group" colliding with things is also weirdly high. In Cueball's metaphor, the "control group" would be his walking around without being distracted, so you would expect him not to collide with anything when able to give his full attention to where he's going. Thus, Megan is implying that Cueball is simply clumsy or easily distracted by other events or his own thoughts, and that his walking into things has little to do with whether he's looking at his phone, in a book or at the sky. Cueball responds defensively, saying that "walking [without bumping into anything] is hard, okay?"

Walking actually is a difficult task, as can be observed when trying to teach a robot how to walk, or the time it takes for children to learn it and the way that a baby's first steps are celebrated as an achievement and a milestone in their development. Of course, walking is much easier (for most people) once they've mastered the basics.

In the title text, Randall remarks that his childhood spent walking around with his nose in a book has prepared him "unexpectedly well" for today's world. Years ago, walking around while staring at something in your hands — such as a book — was considered odd, antisocial and dangerous, and was mostly the province of bookworms and nerds. Yet now, it's commonplace for people to walk around staring at their phones. This makes those "antisocial" people who grew up used to walking around while reading the best-adapted to navigating while using a smartphone.

#1711: Snapchat

July 25, 2016

For obvious reasons, the prize is awarded at a different time of year from the others, while it's still fresh in the committee's memory.

Explanation

Snapchat is a photo-sending app that allows the receiving user to view the photo (known as a "snap") only within 24 hours of its posting, and for only 10 seconds before it is deleted. The Pulitzer Prize is famously awarded for exceptional journalism and photojournalism (there are many categories; see here).

Cueball reads that the Snapchat Pulitzer Prize has just been awarded but then, when Megan states that she heard the picture was really good, Cueball becomes disappointed because he realises he has already missed out on the chance to see the prize winning entry due to the temporary nature of Snapchat. Note that Megan also missed the opportunity to see the snap.

A given snap can be sent to a semi-public "Story" and the user decides how long any user can see the snap in a range from 1-10 s. In principle, any specific snap is only accessible for 24 hours even if it is a story. A committee of users could have more than 10 seconds to access the snap, by viewing in sequence. Given the time it might take for a committee to decide which snap wins the prize, it is realistic that Cueball learns about the winner after the 24 hours is up; Thus even a user following the outcome might not be able to see the winning entry after that time. In practice it is possible to circumvent the Snapchat rule and take a screen shot or in other ways save the content of the snap. In the case of a Pulitzer Prize winning photo, someone would probably have saved it,

if it was in real life. On the other hand, the only way for the photo to be recognised as a snap, eligible to win the prize, would be if no one could see it for more than 10 seconds. So one of the possible rules might be that any picture which was saved would not be able to win the prize.

The title text extends this ephemeral nature of Snapchat's content to the prize awarded for it: The other Pulitzer prizes are announced annually in April and awarded in May (except for 2016, the centennial year, when an awards dinner was held in October). The Snapchat Pulitzer Prize alone must be awarded as quickly as possible after the winner has been decided, before the prize committee forgets what the winning picture looked like. This of course underlines how silly this idea is, because only images seen during the assembly of the prize committee can be seen and remembered, and it is not possible to arrange this based on any knowledge of when a Pulitzer Prize "worthy" snap will be released.

Randall could be making fun of Snapchat (see the title), and the idea that you cannot save the images for later; As mentioned regarding screenshots, it is actually very easy to save pictures from Snapchat - to many a user's regret after having sent something very personal, such as naked pictures of themselves. The comic could also be seen as mocking the Pulitzer Prize for having too broad a spectrum of categories. Alongside the (photo)journalistic and prose awards, the Pulitzers also honor a variety of artistic pursuits, including Poetry, Drama and Music.

The new medium of Snapchat is certainly a hybrid form of art and information/opinion dispersal, both at its best and at its worst, but it is too ephemeral for awarding prizes to be logistically possible even if it were taken seriously enough for someone to want to award them.

The very next comic, 1712: Politifact, features an organization which was awarded the Pulitzer Prize for National Reporting in 2009.

#1712: Politifact

July 27, 2016
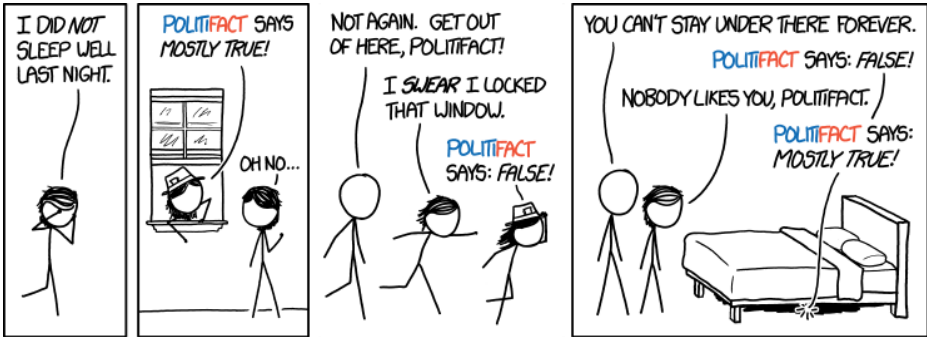
"Ok, I lit the smoke bomb and rolled it under the bed. Let's see if it--" ::FWOOOSH:: "Politifact says: PANTS ON FIRE!"

Explanation

The website PolitiFact.com rates political claims based on how true they are. The rulings from the Truth-O-Meter™ at PolitiFact are:

• True

• Mostly True

• Half-True

• Mostly False

• False

• Pants on Fire!

This comic presents a woman wearing a white hat with a press pass in the hat's band. She is calling herself "PolitiFact" - either pretending to come from PolitiFact.com or she is representing a personification of the website itself. She is obviously annoying Megan and Cueball by first breaking and entering and then rating everything they say on the Truth-O-Meter. (She is using the official logo of PolitiFact as her name, and since they write their name PolitiFact her name should also be written like this, even though Randall has named the comic Politifact with all lower case letters and also uses it like this in the title text.)

When Megan, apparently just having gotten out of bed, says she had trouble sleeping, the PolitiFact.com woman (henceforth simply PolitiFact) appears at an open window and observes that Megan is telling the truth with

the rating of "Mostly True!" (So according to PolitiFact she did not sleep well most of the night, but may have slept OK for some parts of the night.)

Megan appears distressed, which is not improved when PolitiFact enters their house through the window. Megan gives chase to PolitiFact, passing by Cueball, whose comment Not again makes it clear that this is not the first time PolitiFact has annoyed them in this way. Megan swears that she had locked the window, though PolitiFact gives that claim the rating of "False!" as PolitiFact herself demonstrated. Although entering someone's house against their wishes is illegal, regardless of how entry is achieved, Megan's failure to secure the window means that PolitiFact cannot be charged guilty of breaking and entering - and, more pressingly, has made it easier for PolitiFact to annoy them.

Cueball asks her to leave as Megan chases her through the house. After the chase, PolitiFact ends up hiding under the couple's bed; Cueball's claim that PolitiFact "can't stay under there forever" is promptly rated "False". Megan's remark, however, that no one likes PolitiFact, is rated "Mostly True!" This exchange is likely metaphorical just as much as it is literal — Randall's PolitiFact acknowledges that what she does annoys people, but she keeps on doing it anyway.

As for metaphors, Megan is likely commenting on the popularity of the website, which Randall's PolitiFact is no less correct about. People become very defensive when claims they make in political discussions are

debunked by PolitiFact.com. There is a phenomenon where the people most influenced by an erroneous claim are the least likely to believe a fact checker. For example, The Washington Post shut down their internet rumor fact checker because, "institutional distrust is so high right now, and cognitive bias so strong always, that the people who fall for hoax news stories are frequently only interested in consuming information that conforms with their views — even when it's demonstrably fake." Simply put, people like the idea of a fact checker until they disagree with it.

PolitiFact.com has been accused of being both liberally biased and conservatively biased at various times and has angered politicians on both sides of the aisle. The summary statistic "rulings" are especially troublesome; often the critics will agree that the information presented by the fact check is correct, and may agree that all relevant information has been included, but will disagree as to the importance of context omitted by the original speaker or the interpretation of ambiguous language.

The title text makes a play on PolitiFact.com's most untrue rating, "Pants on Fire!" - a reference to the childhood accusation "Liar, liar, pants on fire!"

In the title text either Cueball or Megan says to the other that they have lit the smoke bomb and rolled it under the bed near PolitiFact (seems they have discussed this first). When it goes off it apparently manages to ignite PolitiFact's pants - thus, PolitiFact's pants are literally on fire and she yells "PANTS ON FIRE!". Cueball has

thrown smoke bombs before while in a relation with Megan, see 486: I am Not a Ninja, so it would be likely he had a smoke bomb on his person for immediate use.

Alternatively, either Cueball or Megan just says this as a threat (they could even roll a non-bomb object under the bed and maybe they have talked out loud about the idea of using such a bomb before) and they could try to make the loud fwooosh sound themselves to simulate that the bomb going off. Then they would be telling an outright lie that would be rated as "Pants on Fire!". The fact that the fwooosh is located outside of the "quotation marks", is no indication as the sound is not part of the quote. Also the fact that "PANTS ON FIRE" is yelled, rather than calmly delivered in the fashion of her other judgments, is not necessarily any indication that this is not the case, since a threat that is so blatantly a lie as to warrant such a rating should be proclaimed out loud.

It is also possible that PolitiFact's rating is a meta check of the title text itself; because the scenario described is not illustrated as is the rest of the comic, it has not happened, and thus is blatantly false.

It may be a coincidence, but PolitiFact.com was awarded the Pulitzer Prize for National Reporting in 2009 for work done in their first full year of work (after it was started in August 2007), and this comic was released right after 1711: Snapchat, which hinges on the existence of little-known Pulitzer Prize categories.

PolitiFact was later referenced indirectly with a fact

check in 1790: Sad which is rated mostly false, and directly in the title text of 2129: 1921 Fact Checker, about, well... fact checking.
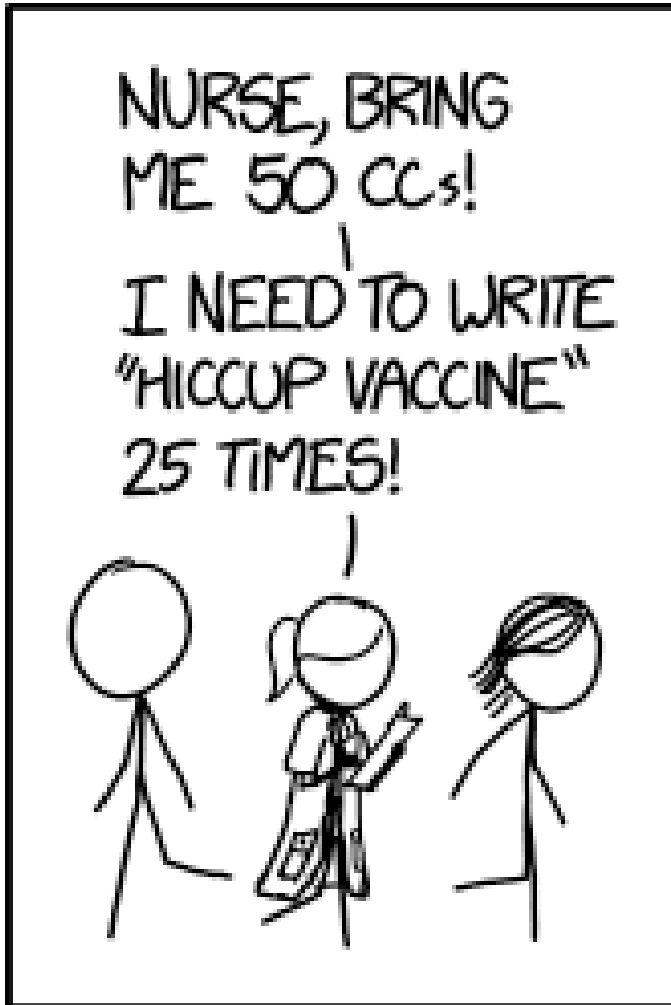
There's been a raccoon accident at an accordion bacchanalia! Double doses!

Explanation

This comic presents a busy day in the clinic for doctor Ponytail, who orders 50 CCs from a nurse (probably Megan who walks in front of her rather than Cueball walking away behind her), all the while everyone is hurrying along the hall. This could be a typical scenario in a busy hospital. However the pun is that the 50 CCs are not medicine but should be used to write "hiccup vaccine" 25 times.

In medicine, "CC" usually means "cubic centimeter", and is often called that by medical personnel. A cubic centimeter is equal to 1 ml (milliliter), so "50 CCs" usually means 50 ml of a certain medicine. In this case however, the doctor has not told the nurse to bring 50 CCs of any given medicine; instead, she needs to write "hiccup vaccine" 25 times, with both words containing the letter combination "cc", so she needs to write that combination 50 times.

There's no conventional vaccine against hiccups. However, performing tasks meant to distract one's self is a method to stop hiccups. Therefore the act of writing "hiccup vaccine" 25 times would itself comprise one more of those hiccup cures that never seems to work. What these techniques all rely on is that they all force one to hold one's breath, thus resetting the diaphragm from its out of sync spasms. But if Ponytail has discovered a vaccine that does somehow cure or prevent hiccups, then this unexpected result is worth reporting in medical

journals and seeking grants for further study. Thus, wanting to write about it 25 times is understandable!

The title text text refers to a fictional event (a wine festival with music played on accordions that has had an accident involving raccoons) with four words containing "cc" (raccoon, accident, accordion, bacchanalia), which means she needs to write "cc" 100 times. Referring to the 50 CCs from above, this would be a double dosage.

A similar doctor Ponytail is shown in 883: Pain Rating also along with Cueball and Megan and just with Megan in 996: Making Things Difficult.

#1714: Volcano Types

August 01, 2016
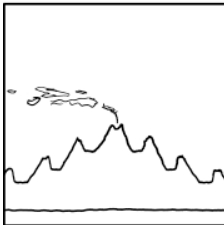
It's hard living somewhere with antlions, because every time you find one of their traps, you feel compelled to spend all day constructing a tiny model of Jabba's sail barge next to it.

Explanation

This comic presents a table of 12 different types of volcano. Split into 3 rows, the first 4 are authentic types of volcano; while the remaining 8 are parodies, one not even trying to represent a volcano but shows a real animal in its inverted trap cone.

Volcanoes have featured in many xkcd comics, most prominently in the left part of the world (the Lord of the Rings section) of 1608: Hoverboard. This comic's volcano looks like it could soon turn into a Somma volcano.

Real volcanoes[edit]

- Cinder cone: small, steep-sided volcano formed of scoria and ash.
- Shield volcano: wide, rounded volcano formed of solidified lava flow.
- Stratovolcano: large volcano formed of layers (strata) from multiple eruptions.
- Somma volcano: new volcanic cone in the middle of an old collapsed volcanic crater.

Joke volcanoes[edit]

- Metasomma volcano: nested layers of somma volcanos i.e. a whole set of new volcanoes (three in this situation) formed inside of old ones. "Meta" is a prefix that often denotes recursion. (Although this is a joke volcano, metasomma volcanoes do actually exist in real life, with one example being

the Krakatoa group in Indonesia.)

- Waffle cone: type of pastry that ice cream is served in, related to volcano cones only insofar as they are the same shape, but typically the waffle cones are turned the other way up to keep the ice cream inside. If the tip of the waffle cone is not filled with solid chocolate or similar, then the contents may very well melt and run out the bottom like the smoke coming out at the very tip of the Waffle cone volcano.

- Science fair cone: common elementary science experiment that is often used as a project for science fairs. A structure is built to resemble a model volcano and is filled with a mix of baking soda, vinegar, and sometimes food coloring. The reaction between baking soda and vinegar quickly produces a large amount of carbon dioxide, creating a foam that overflows and mimics a volcanic eruption. In this picture, there are people running away from the volcano that are much smaller than it. This is likely a reference to 1611: Baking Soda and Vinegar, either the scale-model people on the first volcano, or real people running from the baking soda supervolcano (in this case two Cueball-like guys and Megan).

- Doot cone: This may likely be a reference to the meme of the skull-trumpet where the trumpet playing skull produces the sound Doot as a large part of the meme. Doot is also a fart sound; a doot cone could be just ejecting farts instead of lava.

There has been some discussion about if this is likely, with someone referencing the DOT cones, traffic cones approved by DOT or the Department of transportation in the US.

Also there have been mention of Dot-com coming close to Doot cone. The Dot-com bubble could be said to burst, just like this

volcano bursts/erupts.

- Antlion: An antlion is the larva of an insect known as the lacewing, and is commonly called a doodlebug. These insects dig pits in the sand to use as traps; when a bug comes along and falls in, the sand collapses and falls on the bug, making it very difficult to escape. The antlion then eats the unsuspecting prey. Maybe a reference to Formica Leo, a small volcanic crater in the Reunion island named after the antlion. Also, a recurring boss villain in the video game Final Fantasy series, as well as an enemy in the Half Life series. Also appears in the Moomin (1990) TV series as a literal black lion.

- Inverse Volcano: as the name implies, a regular volcano but reversed. A real volcano consists of solid rock on the outside, magma on the inside and spewing lava from the top. This one is made of lava with rocks erupting out of it.

- Ghost Vent: cone with ghosts coming out of it.

- Pedant's Bane: the joke is that people sometimes confuse magma and lava, which are different names for the same heated liquid rock. Magma becomes lava when it emerges from a volcano. The Pedant's Bane volcano is therefore impossible by definition, but if it were possible, then a pedant would have met their bane (i.e. their downfall), because when they corrected someone's description of this volcano, the pedant would actually be wrong. Alternatively, the illustration itself could be Pedant's Bane because a pedant would be lured into pointing out how wrong it is. This is a direct reference to the pedant in 1405: Meteor.

The title text refers to a famous scene in Star Wars: Episode VI - Return of the Jedi where Jabba the Hutt intends to feed Luke Skywalker to the sarlacc, an underground creature that builds a

huge funnel trap similar to that of an antlion. Jabba's distinctive sail barge features prominently in that scene, and when Randall comes upon an antlion he can't help himself starting to build a scale model next to the antlion's inverted cone. Given how small antlions are, this will be very difficult to do, see for instance 878: Model Rail.

#1715: Household Tips

August 03, 2016

To make your shoes feel more comfortable, smell better, and last longer, try taking them off before you shower.

Explanation

This is another one of Randall's Tips, this time with a series of household tips. The comic is a continuation of 1567: Kitchen Tips, which had four kitchen tips and then a household tip in the title text.

The comic shows Cueball explaining many things one should already know (and are likely already doing without needing to be told), but telling them like most people usually never do it to comedic effect. Below is a list of the five household tips given:

In the bathroom[edit]

To conserve water, try turning off your shower before leaving home: Implies that the shower would "normally" be on at all times, which would be very wasteful. The what if? article "Faucet Power" illustrates similar wasteful and destructive water use. This may be a reference to the common recommendation that people should unplug appliances when they are not in use, as opposed to simply turning them off, as some devices have a "standby" mode that still uses up a small amount of electricity.

Extinguishing fires[edit]

Sick of changing those smoke detector batteries? Eliminate any fires in your house and the batteries may last for months or years!: A smoke detector on standby consumes much less power than one constantly ringing, since standing by only requires that a detection circuit (which draws little current) be on and an LED flashes a few times a minute (which also consumes very little

power), while a buzzer used to sound the alarm uses much energy by comparison. The sentence implies that some people have their fire alarms beeping at all times due to their ongoing fires, and then stop up to change the batteries when they stop working. It is surreal that Cueball would have fires just around his house and not be remotely worried.

Of course, keeping one's house fire-free at (mostly) all times is usually done because of other benefits than just saving on batteries, such as preventing fire and smoke damage to valuable property, infrastructure, and human bodies. [citation needed]

Toilet bowls[edit]

Tired of clogged toilets? Try leaving the lid on the upper chamber and use only the lower bowl!: The "upper chamber", the toilet's cistern tank, delivers plain water to the lower bowl at speed to flush the latter. As such, the pipes that direct the water down are not wide enough for waste to pass. There is typically a lid on the upper tank, because it isn't intended to be used; however, access is occasionally needed to fix or replace the flushing mechanisms. The lower bowl, as one should be familiar with, is the one intended to receive solid waste or defecation [citation needed] and is connected to the plumbing by pipes wide enough for this purpose.

Near the window[edit]

Fresh air doesn't have to be expensive. Many windows can be slid up to create a temporary hole without the usual cost and cleanup!: This suggests that the people he appeals to typically smash a window (or a wall) to get fresh air, hence the clean up and expensive replacement of the window, once enough fresh air has

been obtained.

Title text[edit]

To make your shoes feel more comfortable, smell better, and last longer, try taking them off before you shower.: People typically remove all their clothing, including and/or especially shoes (except perhaps for some lightweight sandals to protect the feet in public showers), when showering, so while it is certainly true that removing one's shoes before showering will allow them to last longer and stink less (since shoes that have little opportunity to dry produce malodorous molds), this is not in any way a novel idea.

#1716: Time Travel Thesis

August 05, 2016
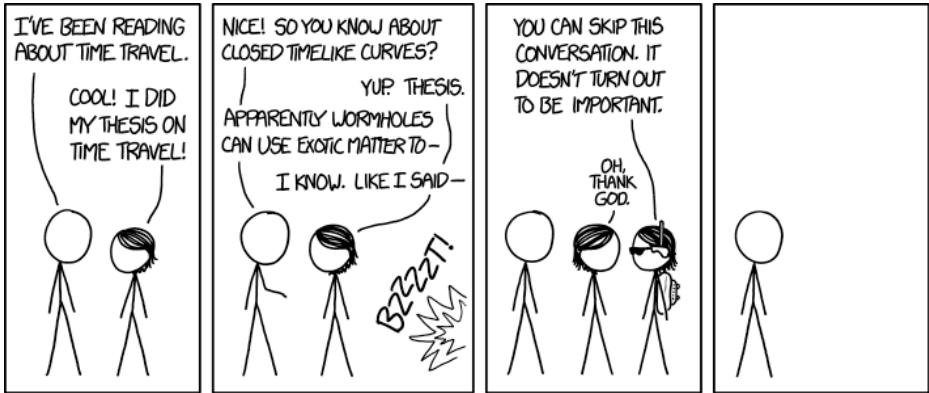
'Hey, what are those futuristic goggles for, anyway?' 'Oh, this is just a broken Google Glass. It was 2010's night at the club.'

Explanation

Cueball has apparently been reading about time travel. He tells Megan about this, and Megan excitedly remarks that she did her college thesis on time travel which basically means that she is supposed to know a lot more about time travel than a guy who has just been "reading" about it.

Cueball, however, continues to ask her if she knows basic facts about time travel (like closed timelike curves, wormholes and exotic matter), like he is investigating if he has discovered facets about it that she would have overlooked while writing a thesis about it. Megan keeps trying to say that since she wrote a Time Travel Thesis, (hence the title of the comic), she already knows all of this and much, much more, and she is obviously getting frustrated by Cueball's attempts to impress her with his "knowledge".

At this point Megan's future-self arrives with a Bzzzzt, having used time travel to arrive at this exact moment in time. It seem she has continued her research and has successfully managed to make a time machine.

The reason she arrives is only to tell her younger self that this conversation with Cueball doesn't go anywhere and isn't important, and so present-Megan can leave and not waste her time anymore. Up till then, Megan was presumably reluctant to break off a conversation on the topic of time travel, since the conversation could

potentially have improved, or perhaps because he at least had read about time travel which is a subject she would have a clear interest in since she wrote a thesis on it. But once the conversation began to run off track, it came as a relief to know that she could quit without the risk of missing out on anything important. Also, since Megan took the effort to time travel back to this exact moment, that must mean the conversation was so boring and uneventful she kept regretting having this conversation even far into the future to the point where she remembers it as one of the moments that need to be changed with her acquired time travel abilities.

And then she just walks away with her future-self leaving Cueball hanging in the last panel, having invented a completely new way to get out of useless/boring conversations.

Alternatively, future-Megan just makes an excuse to haul present-Megan off in order to prevent the latter from disclosing some details of time travel science to Cueball, which could have unintended consequences. However, using very advanced technology, or even violating physics law, for very mundane ends is very common in xkcd, so using time travel to prevent useless conversation is not surprising from Megan.

In either case, future-Megan finished this conversation before inventing time travel, and thus knows this conversation's outcome. So by coming back, she now changes her own (and Cueball's) future. Of course the general implications of being able to travel like this are

enormous, and the paradoxes arising from such a possibility are endless, the most pressing (at the moment) being the grandfather paradox, where a time traveler creates circumstances that negate their existence (such as killing their own grandfather), in this case, Older Megan going back in time to stop Younger Megan from finishing this conversation, who will eventually become Older Megan but with no reason to go back to tell Younger Megan to stop this boring conversation. It is worth noting, however, that the comic does not inherently cause a paradox: so long as the Megan who didn't finish the conversation stills travels back in time with the knowledge that the conversation needed to be stopped and still saves her younger self from wasting her time, a time loop can be logically sustained. (It is also worth noting that a "Mobius" time loop is also perfectly possible, the grandfather paradox isn't a paradox if quantum entanglement is taken into account - something Megan would no doubt know)

It is possible that Randall may have had some conversations like this, where after having spent a lot of time getting nothing out of it himself, would have wished his future self had come back to tell him to just leave the conversation now.

In the title text present-Megan asks future-Megan about her futuristic googles and what they are for, presumably assuming they are needed for the time travel (maybe it is the backpack?). People from the future wearing weird clothing, often involving eyewear of some sort, is a common trope in Science-Fiction. Movies like Back to

the Future Part II (which tried to predict the fashion of 2015 back in 1989) didn't get it right, so this might be a commentary on those movies. However it turns out it's just some old and broken Google Glass. The only reason future Megan wears these is that she attended a party at the club that had a 2010s' night theme, possibly one at which similar futuristic gear is worn by other xkcd characters in the future, in 318: Nostalgia.

The fact that the Google Glass is broken and from 2010 alludes to Randall believing that the project was a fad that and that it will never pan out, even in the future. Indeed that seems to be the case. It seems generally that Randall is no fan of Google Glass, which was also shown earlier in 1251: Anti-Glass and later again in 1304: Glass Trolling. Google Glass has become a recurring theme in xkcd.

This is an indication of how far from the future she has traveled, as Google Glass was first released in the 2010s. It is not clear whether she is wearing Google Glass because it became popular in the 2010s or because it was an esoteric piece of hardware that people would readily associate with the 2010s. Consider that it is the 2020s, and we celebrate '90s and '00s parties. So it is safe to assume that Megan is at least from the 2030s. Also people attending retro dress-up parties frequently make mistakes and do not dress up exactly in-style, creating some anachronisms, especially if they dress up like they did many years ago.

#1717: Pyramid Honey

August 08, 2016
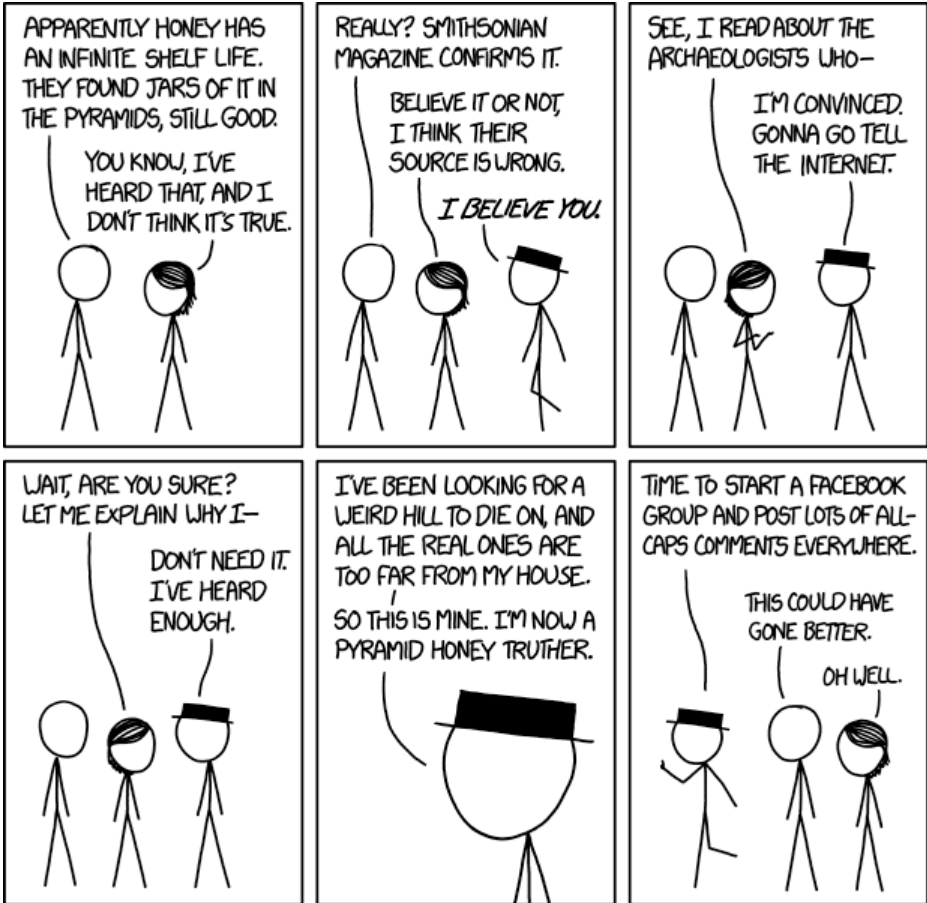
They CLAIM honey was found in the chambers under the pyramids, but this conspiracy goes all the way to the TOP, where the GIANT EYE is!

Explanation

Bee honey is a food item with natural antimicrobial properties. It can remain unspoiled for a person's entire lifetime, making it practically nonperishable for ordinary consumers. It is frequently claimed that archaeologists have found jars of honey that have been well-preserved for thousands of years in ancient tombs, often those found in Egyptian pyramids, hence the title Pyramid Honey. The claims are generally assertions that may point to other similar assertions as supporting evidence but do not provide specific details, such as the identity of the actual tombs where such jars have been found, or the names of the archaeologists who have affirmed finding such jars. Repeated encounters with the assertion lead some people to claim that honey's shelf life is "infinite", which is a much stronger claim which would not necessarily be supported by the assertion even assuming it is true.

In the comic, Cueball tells Megan about an article in Smithsonian Magazine (presumably this one) that claims honey has an infinite shelf life. The article links to a book that makes the assertion of such findings but does not provide factual support of the findings. Megan thinks the source for this article, and others that covered the subject, is wrong and wants to refute them all. She tells Cueball Believe it or not which Black Hat hears and he immediately states that he believes her, and is convinced without hearing any arguments from Megan. He then decides to begin a Facebook page so he can tell the

Internet without giving Megan a chance to explain any further.

"A hill to die on" is a phrase from Ernest Hemingway's 1940 novel "For Whom the Bell Tolls", about an American who volunteers in the 1936-1939 Spanish Civil War to fight fascism, who ends up wounded and alone, about to ambush the enemy to give his comrades a chance to escape; "a weird hill to die on" would thus mean a weird cause, if not a just one, to fight for to the bitter end. This expression is also the subject of 2247: Weird Hill. Black Hat asserts that he needs such a cause because the "real" weird hills are too far from his house, humorously implying he would be equally satisfied with a literal weird hill.

Black Hat's actions are clearly premature since he has not heard any evidence to back up the claim and does not understand the nuances of Megan's position. Cueball states that it could have gone better, whereas Megan seems to be resigned to it, perhaps as it notionally supports her (aborted) argument and it's at least a short-term 'win' that she won't fuss over the details of.

Presumably, the best Black Hat can do would be to parrot what he has heard from Megan, without any understanding or critical thinking on his part. Due to his lack of understanding, he may even interject his own ideas (ones Megan never believed nor stated) into his posts. These are all consistent with him calling himself "pyramid honey truther". The word truther refers to people who reject established facts and instead choose to

believe in conspiracies, like people who claim the moon landings never happened, or believe the US government is behind the 9/11 attacks. While a few conspiracy theories turn out to be true, most are easily proved to be fake, but this does not stop people from believing in them anyway, just like the two mentioned here, which are not easily dismissed by believers. This turns Megan, who likely has a reasonable and well-justified position, unwillingly into the source of conspiracy theories.

Alternatively, he only does this to troll Megan (and Cueball), and everyone else that reads his Facebook page, just because he knows they will get annoyed. And also to state that this is an unimportant subject (a weird hill to die on) to make such a fuss over. No one would wish to eat that honey, anyway, having been abandoned to time for that long.[citation needed] He may see this as a completely uninteresting subject and thus makes fun of Megan with his statements. This would also be more in line with his usual behavior.

It is also possible that Black Hat is simply mocking conspiracy theorists' obsessions with factually incorrect ideas, comparably to what may be the case in Secretary: Part 3.
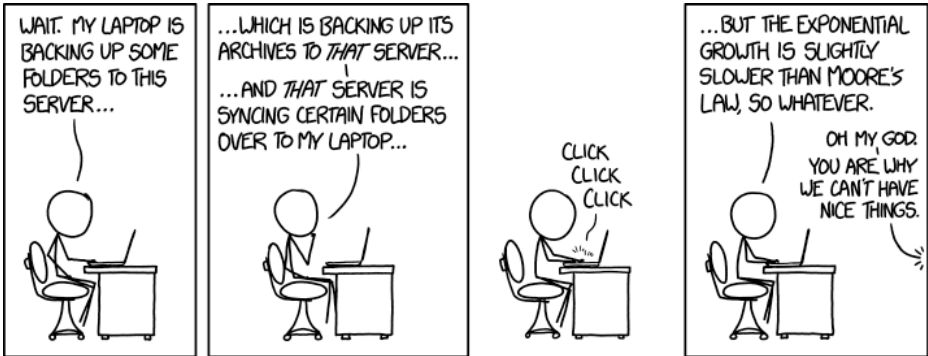
The title text refers to the Eye of Providence, a symbol of an eye at the top of a pyramid, found on US currency and often associated with conspiracy theories of the Illuminati. Black Hat again refers to the pyramid honey found under the pyramids and calls it a conspiracy that goes all the way to the top. This usually means that the

politicians (or the government agencies) ruling the country know about it, but keep it a secret from the public. But in this case, he mixes up terms and says it goes to the top of the pyramid (from the bottom), to where the giant eye is. As promised he also writes four words in all capital letters, shouting out the TRUTH!

This comic is likely a satire of the stereotypical internet mindset and plays up the frequent confusion between legitimate scientific skepticism, where unsupported claims are rejected, and conspiracy-theory faux-skepticism, where legitimate evidence is rejected because it does not support a specific viewpoint.

#1718: Backups

August 10, 2016

WAIT. MY LAPTOP IS BACKING UP SOME FOLDERS TO THIS SERVER...

...WHICH IS BACKING UP ITS ARCHIVES TO *THAT* SERVER...

...AND *THAT* SERVER IS SYNCING CERTAIN FOLDERS OVER TO MY LAPTOP...

CLICK CLICK CLICK

...BUT THE EXPONENTIAL GROWTH IS SLIGHTLY SLOWER THAN MOORE'S LAW, SO WHATEVER.

OH MY GOD. YOU ARE WHY WE CAN'T HAVE NICE THINGS.

Maybe you should keep **FEWER** backups; it sounds like throwing away everything you've done and starting from scratch might not be the worst idea.

Explanation

On his laptop, Cueball explores a cyclic path along which his files are being copied from storage to storage. His laptop (presumably the one he is on) is sending its files to a server, which sends its files to another server, which in turn syncs back a certain selection of files to his laptop. Cueball determines that this setup leads to an exponential growth, implying that each node in the cycle simply copies files over to the next without any effort to avoid duplicates. Indeed, each time a set of files completes a full cycle, duplicates of the same files are propagated.

Moore's Law is an observation in computer engineering (made by engineer Gordon Moore in 1965) that states that the number of transistors we can fit in a chip will double approximately every two years. Cueball, who was rather alarmed, calms down when he realizes that the exponential growth of his backup is slower than that of Moore's Law. He reasons that as long as he keeps at the forefront of information storage, he will never run out of room. Assuming available disk capacity is proportional to number of transistors (this is roughly true for solid-state disks) or otherwise keeps pace with Moore's Law, this would imply it takes more than two years for his files to completely propagate through two servers and back to his laptop enough times to double in size (implying either an extremely slow transfer or an extremely weird backup system).

The phrase "[this is] why we can't have nice things" is often used in response to incidents where someone abuses a well-meaning feature, with the abuse ultimately wiping out any benefits the feature was supposed to bring. In the comic, the person off-screen is commenting on the fact that Cueball is not using advances in storage capacity in a responsible manner. That is, rather than using the increased capacity to store more useful information, he is simply using it as a workaround to avoid having to make his backup strategy more efficient.

This concept is further expanded upon in the title text when somebody, presumably the off-screen speaker, notes that Cueball may be better off taking fewer backups in the hopes of losing some data. Typically backups are taken in the hopes of not losing programs and data. However, if the inefficient backup solution presented is representative of the other things Cueball has created, it may be better to have it all be lost and in effect force it to be re-created in a hopefully superior way.
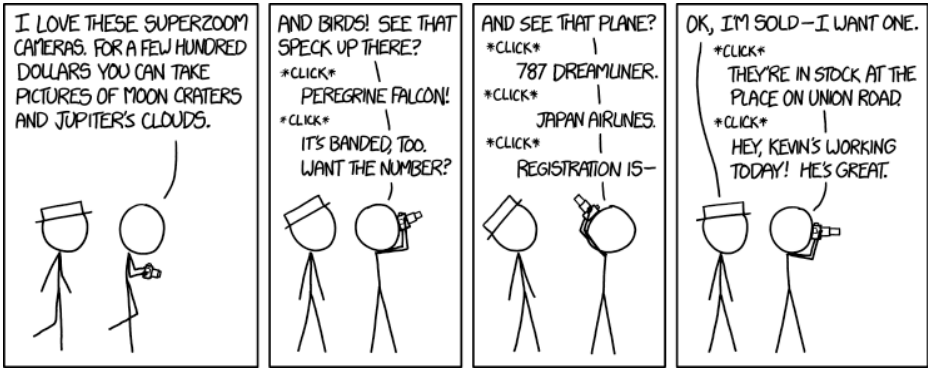
There are some similarities to the Cueball who owns the computer in the 1700: New Bug and maybe also to the Code Quality series: 1513: Code Quality and 1695: Code Quality 2, where Cueball speaks with Ponytail.

Poor backup strategies are referenced in 1360: Old Files.

#1719: Superzoom

August 12, 2016

click Let him know he's got a stain on his shirt, though.

Explanation

In this comic, Cueball is showing off his new superzoom camera to White Hat. These are cameras with large zoom lenses, often 25× or higher magnification. He is very excited and starts by exclaiming how they can take detailed photos of the craters on the Moon, and (on better models) relatively large photos of Jupiter even with a resolution so individual clouds can be seen. (See examples of zoom on these objects here and here without cloud resolution though, but with Jupiter's four large moons and Saturn's rings.)

He then spots a bird (which is just a speck in the sky) and uses the superzoom for birdwatching, which is a popular use for these cameras. He can see that it's a peregrine falcon and that it has been banded (ringed) and he can even read the number on the band (later it seems he has more trouble locating birds with his camera in 1826: Birdwatching). He then spots an airplane and having taken a picture of it, he can tell that it is a 787 Dreamliner from Japan Airlines, and he can even make out the registration number. All this is possible, with a Nikon Coolpix P900, which may not be much larger than the one Cueball stands with here, with an extremely long lens, and at the time of this comics release that type of camera could be bought at Amazon for less than $600. If that is within the limit Cueball gives of a few hundred dollars can be debated...

Note that before each comment he has taken a picture,

presumably zooming further in after each photo of each new object, zooming out again before beginning with the next object.

Finally, White Hat exclaims that he is sold and states that he also want a superzoom camera like Cueball's. Cueball then points the camera down the street, takes a picture, and tells White Hat that the shop on Union Road has these cameras in stock, indicating that he can see them inside the store (or in their window). He then takes another picture and is able to recognize the worker in the store, Kevin. As mentioned in the title text, after taking another picture he notices a stain on Kevin's shirt and asks White Hat to tell Kevin about the stain when he goes there to buy a superzoom camera. (This was the first time the name Kevin was used in xkcd for a fictive person, see more in this trivia).

Even with the ability of these cameras, it would be difficult for Cueball to be able to make out a specific worker inside the store, but if he is standing near a window it is not impossible, and if he has a stain on his shirt, it is in the same league as spotting a band on a bird in the air. Of course he has to be in a spot where he can see straight to the front of the shop.

The last panel and title text is also a remark on how such cameras can be used to spy on people for quite a far distance, which has often been (ab)used by paparazzi photographers taking pictures of famous people (often while almost naked or in a bikini or other bathing clothes). Now everyman gets this disconcerting

possibility to spy on their neighbors and others for just a few hundred dollars.

There are lenses that can do what Cueball describes about Jupiter's clouds in the comic (e.g., the Canon 5200mm), but so far not such a small consumer camera as shown in the illustration.

A couple of other factors that many people may not realize until after they've bought a consumer-level superzoom camera is that a) taking a hand-held picture at maximum zoom is typically rather blurry because the lens is magnifying all vibration and it's impossible to hold the camera steady enough (so a camera tripod would be needed), and b) that the lens' aperture at maximum zoom is typically much smaller than at normal focal lengths, with the result that the shutter time must be several times longer to get proper exposure, compounding the vibration / blurry problem. Modern superzoom cameras do have "image stabilization", which can mitigate blurriness due to vibration, but extreme telephoto photography is still more challenging than implied in the comic.

Also having zoomed so much it is very hard to actually locate a moving plane or bird in the sky while looking at the image shown on the camera. And as shown in the comic the lens is zoomed very much in. Of course this could be done by Cueball after having found the flying object with much less zoom. But still if he loses sight of the bird while fully zoomed in it will be almost impossible to find it again without zooming back out.

White Hat and Cueball have discussed photography before in 1314: Photos.

#1720: Horses

August 15, 2016

DRUNK DRIVING WAS LESS OF A PROBLEM BEFORE CARS. IF YOU GOT ON YOUR HORSE DRUNK AND FELL ASLEEP, IT COULD JUST WALK HOME.

AND IF YOU TRIED TO RIDE INTO A TREE, THE HORSE COULD BE LIKE "NO."

FORGET HUMAN DRIVERS— THAT'S THE BENCHMARK WE SHOULD BE JUDGING SELF-DRIVING CARS AGAINST.

SOON:
THIS BABY HAS 200 HORSES UNDER THE HOOD AND 3.5 IN THE COMPUTER.

OOOOH!

This car has **240%** of a horse's decision-making ability and produces only **30%** as much poop.

Explanation

The programming of self-driving cars has been in the news lately, as engineers and philosophers debate what rules the cars should follow in dangerous situations (for instance, what to do when forced to choose between hitting a pedestrian or swerving into oncoming traffic). Ponytail suggests one approach for solving this problem: to think of the car as behaving like a horse, using its own intelligence and ignoring dangerous commands in the interests of self-preservation.

The comic begins with Ponytail claiming that in the old days, riding a horse or driving a horse drawn vehicle while drunk was less dangerous than drunk driving today. Given the higher speed and the denser traffic today this might seem plausible. On the other hand, modern cars have seat belts, airbags, and other features designed to save lives when crashes do occur; horses and horse-drawn vehicles lacked these safety features.[citation needed] However, if you do fall asleep on a horse, it will not suddenly walk into a tree or other obstacle, and it may actually just stop walking while you sleep.

Ponytail expands the argument by stating the horse itself will be acting in the interest of its own self-preservation. She finally states that in a comparison of the ability of self-driving cars, we should forget humans, and instead it should be the ability of horses that should be the benchmark that the self-driving cars should be judged against.

This segues into a scene in the near future where White Hat is bragging to Cueball and Megan about the features of a car (in order to sell the car to them) by comparing the features to those of horses. Car engines are traditionally measured in horsepower, which (roughly) compares the power output of the engine to that of a horse. White Hat goes a step further, claiming that the car (which is presumably self-driving) has an onboard computer with driving abilities equivalent to 3.5 horses, comparing the car's ability to mitigate for a drunk driver and/or avoid obstacles to that of a horse. White Hat has been depicted as a salesman before in 1350: Lorenz and similarly earlier in 260: The Glass Necklace.

The title text features more comparisons of the car to horses. In the text, Randall states that the car has 240% of a horse's decision-making ability and produces only 30% as much poop as a horse. This statement is absurd because self-driving cars do not usually produce poop.[citation needed] It also suggests that even with 3.5 times as much horse-intelligence as a horse, the car may only have 2.4 times the decision-making ability, although the car in the title text could also just be a different car from the one in the comic.

Note that riding a horse while drunk is in fact still dangerous and illegal in many places (for example, the UK and Ireland). A badly-driven horse can throw off its owner, trample passersby, fall on bad surfaces, and destroy any wagon or carriage it's pulling. A self-driving car should be able to understand road rules, which a horse will not - which is presumably why the cars in the
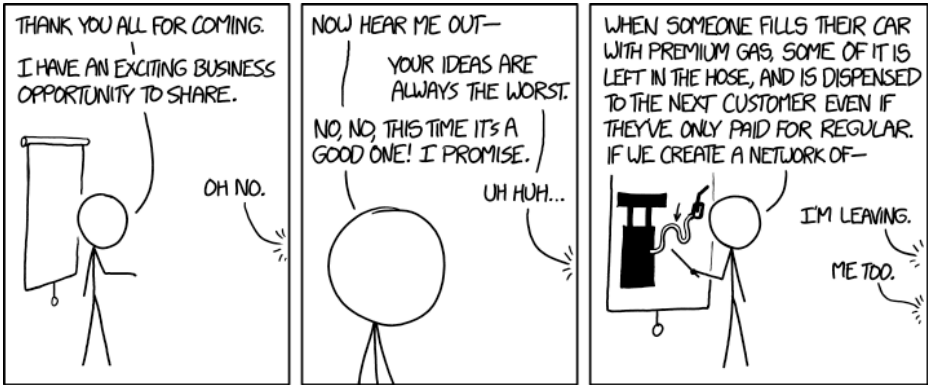
comic and the title text are both specified as being more intelligent than a horse.

In 887: Future Timeline dogs driving cars are mentioned. Self-driving cars is a recurring topic on xkcd. In 1461: Payloads spacecraft mass is measured in horses.

#1721: Business Idea

August 17, 2016

Panel 1:
THANK YOU ALL FOR COMING.

I HAVE AN EXCITING BUSINESS OPPORTUNITY TO SHARE.

OH NO.

Panel 2:
NOW HEAR ME OUT—

YOUR IDEAS ARE ALWAYS THE WORST.

NO, NO, THIS TIME IT'S A GOOD ONE! I PROMISE.

UH HUH...

Panel 3:
WHEN SOMEONE FILLS THEIR CAR WITH PREMIUM GAS, SOME OF IT IS LEFT IN THE HOSE, AND IS DISPENSED TO THE NEXT CUSTOMER EVEN IF THEY'VE ONLY PAID FOR REGULAR. IF WE CREATE A NETWORK OF—

I'M LEAVING.

ME TOO.

Then we move to phase two. Gas stations store fuel in underground tanks. Normally, these are inaccessible except via the pump. However, with hydraulic fracturing, we-- Wait! Come back!

Explanation

In this comic, Cueball announces he has "an exciting business opportunity to share". After hearing discouragement from his off-panel audience, he promises that "this time it's a good one", and goes on to explain his plan.

Cueball's plan involves the premise that a small amount of premium gas is left in a fuel pump hose after a car driver fills their car up with premium gas. Note that not all gas stations leave the fuel in the hose: many pump it back into the tank for storage. He states that even if the next customer only pays for regular gas, that they are still getting a small amount of the expensive premium gas. Though he doesn't get a chance to finish the outline for his plan, one can assume he planned to get premium fuel at regular prices, so he could then sell it for profit. After hearing the first part of his plan, two people from the off-panel audience announce they are leaving, clearly and correctly thinking that Cueball's idea is stupid and impractical.

In reality, this would be an impossible business venture to execute. While in the United States often the same hose is used for the various octane fuels, the amount of fuel contained in the hose is relatively small (about a third of a gallon, or half a liter) compared to the amount that is generally purchased, though for motorcycles the ratio is more significant. It is also illegal to resell fuel without the correct licenses, and it would be difficult,

bordering on impossible, to have the fuel pump run to just the premium fuel out, and driving to each gas station would use more money to buy more fuel than any money that could be made back. This is not to mention trying to keep track of when someone purchased premium so as to be the next person to use that pump to extract those precious drops.

1499: Arbitrage implies a similar plan to extract wealth out of a small market inefficiency that, in reality, would be far too onerous to exploit, in this case reselling the free chips offered at some restaurants. The same idea was also used in 1110: Click and Drag where a person takes free drinks to resell. See also the what if? article Cost of Pennies regarding why it would not be worth trying these kind of ventures out.

The title text is another one of Cueball's fuel-based business ventures, as he says he plans to dig up fuel stations underground fuel storage tanks, to then sell the contents of. Again, illegal/theft, impractical, don't try it (though it would be much more profitable than his previous plan). The punchline is that a gas station's underground tank is "inaccessible" from the outside, just as there are some oil deposits that are inaccessible to traditional oil production techniques because no sufficient natural flow towards a well can be obtained. In the case of oil deposits, high-pressure fluids are pumped into the rock to break it up ("Hydraulic fracturing" also known as "fracking") and allow the oil to reach the well. Oil tanks, on the other hand, can be made accessible by puncturing them using (presumably) hydraulically

powered tools (electrical power is inadvisable in the presence of high-vapor-pressure hydrocarbons due to the significant risk of fire and explosion caused by electrical sparking). The title text of 1662: Jack and Jill also refers to fracking.

#1722: Debugging

August 19, 2016
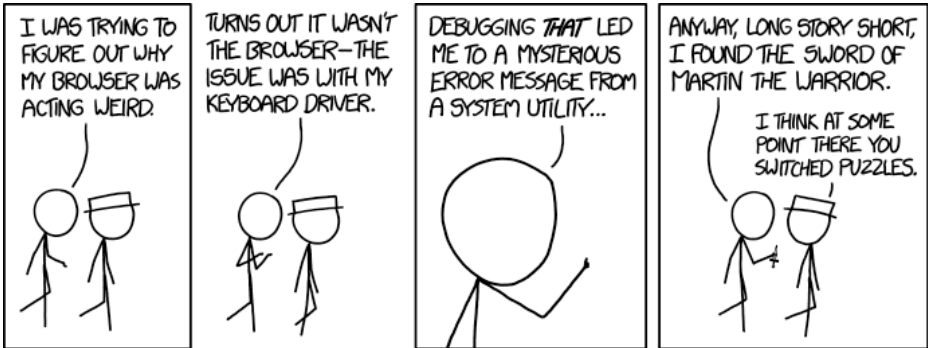
When you Google an error message and it gets no results, you can be pretty sure you've found a clue to the location of Martin's sword.

Explanation

Cueball is telling White Hat about his attempt at debugging, i.e. the process of finding out what is causing a given (computer) problem, which can become increasingly difficult and convoluted. In this case, Cueball had a problem with his browser. His attempts to solve this problem led him to a problem with the device driver for his keyboard. Chasing that issue, he found an unclear error message from a system utility, and so on.

Cueball decides to "make a long story short" by skipping several steps he believes are boring, and he unexpectedly reveals this process has led him to find the "Sword of Martin the Warrior", a legendary relic from the children's fantasy novel series Redwall, implying that the debugging process was so long and convoluted that along the way he somehow ended up with a fantasy quest. This refers to the fact that a complicated riddled path was devised in the series that would lead to the sword, which is similar to the process of debugging, as it involves following clues to achieve an answer. But apart from that, they are entirely different.[citation needed] This is pointed out by White Hat who states that at some point in the process he switched from the puzzle of debugging to the Redwall puzzle of finding Martin's sword. Redwall has been referenced before, most prominently in 370: Redwall; where Martin and the sword can be seen; but also in 1286: Encryptic and more recently in 1688: Map Age Guide.

The characters in Redwall are woodland animals, and Martin the Warrior is a mouse; the sword that Cueball finds is correspondingly tiny.

Googling an error message is a common method used during debugging, often leading to useful information. However, when there are no search results for a given message, it may mean the problem is so obscure that almost nobody had experienced it before. (See also 979: Wisdom of the Ancients about getting only one result.) Or, as the title text hints, it might mean it was a hidden clue to the location of Martin's sword.

#1723: Meteorite Identification

August 22, 2016
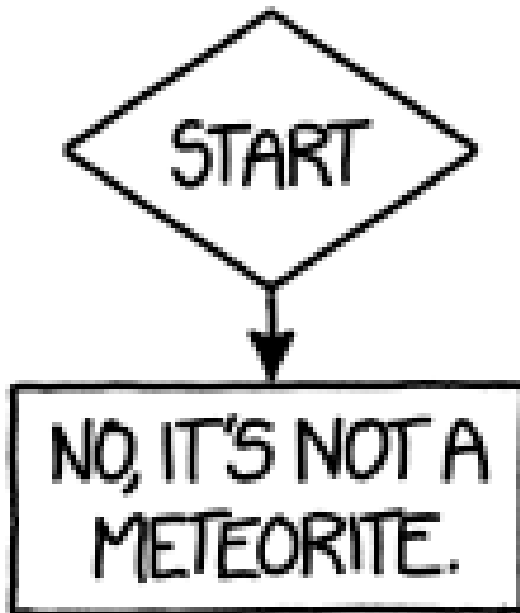
Click for an actual flowchart for identifying a meteorite. My favorite part is how 'Did someone see it fall? -> Yes' points to 'NOT A METEORITE.' This is not a mistake.

Explanation

Meteorites form when a meteoroid survives entrance through the Earth's atmosphere as a meteor. Thus, they are very rare rocks that come from space, and can stem from broken asteroids, the Moon, and sometimes (very rarely) even from Mars.

The flowchart, though facetious, would actually work the vast majority of the time a person picks up a rock and believes it to be a meteorite, since any single rock one finds on the surface of the earth is almost definitely not a meteorite.

Flowcharts are often used (in xkcd) to give the inexperienced a step-by-step process to follow (see a guide to flowcharts here: 518: Flow Charts). Meteorite identification, however, is very difficult, so the brevity of this flowchart in a way pokes fun at the need for a flowchart to identify meteorites, since laypeople are not experienced enough to confirm that a rock is indeed a meteorite. A similar short flowchart as this has been used recently in 1691: Optimization, and another only two box chart was used in 1195: Flowchart.

In the title text Randall mentions that the comic image is a link to the more detailed (now defunct, mirror here) Meteorite or meteorwrong? Self-Test Check list flowchart at the Department of Earth and Planetary Sciences at Washington University in St. Louis.

The authors of those resources notes that they have received many rock samples and photos (or even personal visits) from people claiming to have discovered meteorites and thus they would likely benefit from just providing people the shortcut flowchart from Randall, as a way of saying, "leave meteorite identification to the professionals."

Randall also mentions in the title text that his favorite part of this real flowchart, which is the part where if anyone saw the "meteor" fall then it is 'NOT A METEORITE.' What he most likes about it is that this is not a mistake.

First of all the chance of actually being near a falling meteorite is exceedingly small. From the flowchart was a link to a 64 point long checklist, which basically all ends in "…, then it's not a meteorite." In point 3 is noted the following:

Second, meteors that can be seen falling almost definitely cannot be found on the ground immediately after. Any meteor big enough to glow and be visible while falling all the way to the ground will leave a large impact crater, rather than simply sit on the ground as a rock. Smaller meteors do not fall fast enough to glow all the way to the ground. Either they will burn up completely (not leaving any meteorite) or they will be slowed down before they burn all the way up (but typically end up much smaller than the original meteoroid). After that they will stop glowing and will brake even further until they reach a terminal velocity due to air resistance. Their small size,

and lack of glow, make them practically impossible to follow with the naked eye even in daylight. If a person stands close by the impact location of a meteor it may be possible to hear a swish and a thunk, from when it passes by and then hit the ground. It will then be possible to locate the meteorite, but such a falling stone could also have been dropped from an airplane or by a storm. But in some few cases people have actually heard a real meteor falling and found it afterwards. This is what happened with the 690 events mentioned above. All this is described on How to Identify a Meteorite from The Meteorite Market which is linked in point 48 in the table from Washington University. But they did not see it fall!

What Randall finds so funny about this part of the flowchart is that there are three arrows leading to the question "Did someone see it fall?", but from there only a "Yes" option is possible, and then this gives the result "Not a meteorite." This indicates that if you have found a rock that has no dark crust or regmaglypts (the options that by saying no takes the user to the question about seeing it fall), then it is not a meteorite, and then the only reason people might still believe it to be a meteorite must be because someone saw it fall and assumed it came from space (rather than more likely scenarios, such as a stone coming loose from a cliff or building, or being dropped by a bird or aircraft).

If the rock actually has those thumbprint like impressions on the surface (that scientists call regmaglypts) then the creator of the flowchart actually asks to see the rock (photo or sample). The other features

that are interesting is if it has a dark thin crust (from the melting during entry), but only if it also has either regmaglypts or if it has a lighter color inside than the outer crust.

See also 1405: Meteor about how people mistake the words meteorite with meteor. The many misspellings of meteorite is mentioned in point 63 in the table.

#1724: Proofs

August 24, 2016

Panel 1: ... LET'S ASSUME THERE EXISTS SOME FUNCTION $F(a, b, c...)$ WHICH PRODUCES THE CORRECT ANSWER— HANG ON.

Panel 2: THIS IS GOING TO BE ONE OF THOSE WEIRD DARK-MAGIC PROOFS, ISN'T IT? I CAN TELL.

Panel 3: WHAT? NO, NO, IT'S A PERFECTLY SENSIBLE CHAIN OF REASONING. ALL RIGHT...

Panel 4: NOW, LET'S ASSUME THE CORRECT ANSWER WILL EVENTUALLY BE WRITTEN ON THIS BOARD AT THE COORDINATES (x, y). IF WE— I *KNEW* IT!

Next, let's assume the decision of whether to take the Axiom of Choice is made by a deterministic process ...

Explanation

Miss Lenhart is teaching a math class. She begins a proof when one of her students (Cueball) interrupts her asking if this is one of those dark-magic (unclear, incomprehensible) proofs. She claims no, but in a matter of seconds Cueball is calling out that he was right.

The proof she starts setting up resembles a proof by contradiction. However, after Cueball's interruption Miss Lenhart's proof takes a turn for the absurd: rather than assuming there will be a point in the function that correlates to co-ordinates (x, y), Miss Lenhart assumes that the act of writing numbers on the board will correlate to co-ordinates (x, y).

A normal proof by contradiction begins by assuming that a particular condition is true; by demonstrating the implications of this assumption, a logical contradiction is reached, thus disproving the initial assumption. One example of a proof by contradiction is the proof that $\sqrt{2}$ is an irrational number:

Alternatively, instead of a proof by contradiction the setup could be for a one way function. For example, it is relatively easy to test that a solution to a differential equation is valid but choosing the correct solution to test can seem like black magic to students.

The way that Ms Lenhart's proof refers to the act of doing math itself, is characteristic of metamathematical

proofs, for example Gödel's incompleteness theorems, which, at first sight, may indeed look like black magic, even if in the end they must be a "perfectly sensible chain of reasoning" like the rest of good mathematics. While typical mathematical theorems and their proofs deal with such mathematical objects as numbers, functions, points or lines, the metamathematical theorems treat other theorems as objects of interest. In this way you can propose and prove theorems about possibility of proving other theorems. For example, in 1931 Kurt Gödel was able to prove that any mathematical system based on arithmetics (that is using numbers) has statements that are true, but can be neither proved nor disproved. This kind of metamathematical reasoning is especially useful in set theory, where many statements become impossible to prove or disprove if the axiom of choice is not taken as a part of the axiomatic system.

Using a position on the blackboard as a part of the proof is a joke, but it bears a resemblance to Cantor's diagonal argument where a position in a sequence of digits of a real number was a tool in a proof that not all infinite sets have the same cardinality (rough equivalent of the number of elements). This "diagonal method" is also often used in metamathematical proofs.

The axiom of choice itself states that for every collection of disjoint nonempty sets, you can have a function that draws one element from each set of the collection. This axiom, once considered controversial, was added relatively late to the axiomatic set theory, and even contemporary mathematicians still study which

theorems really require its inclusion. In the title text the decision of whether to take the axiom of choice is made by a deterministic process, that is a process which future states can be developed with no randomness involved. Determinacy of infinite games is used as a tool in the set theory, however the deterministic process is rather a term of the stochastic processes theory, and the dynamical systems theory, branches of mathematics far from the abstract set theory, which makes the proof even more exotic. The axiom of choice was mentioned earlier in 804: Pumpkin Carving and later in 982: Set Theory, another comic about a math class with a similar theme on how teachers teach their student mathematical proofs.

Although Miss Lenhart did retire a year ago after 1519: Venus, she seems to have returned here for a math course at university level, but continues the trend she finished with in her prior class. A very similar Miss Lenhart comic was later released with 2028: Complex Numbers.

#1725: Linear Regression

August 26, 2016
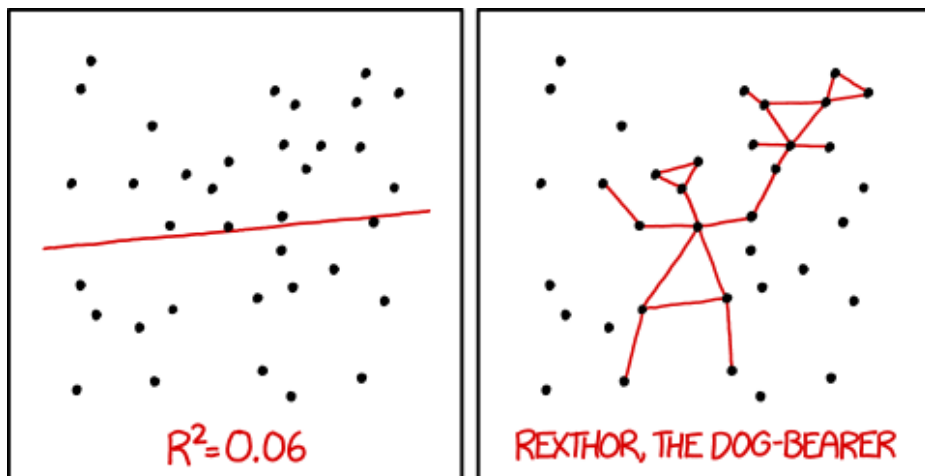
I DON'T TRUST LINEAR REGRESSIONS WHEN IT'S HARDER
TO GUESS THE DIRECTION OF THE CORRELATION FROM THE
SCATTER PLOT THAN TO FIND NEW CONSTELLATIONS ON IT.

The 95% confidence interval suggests Rexthor's dog could
also be a cat, or possibly a teapot.

Explanation

Linear regression is a method for modeling the relationship between multiple variables. In the simplest case, it can be used for two variables wherein the model determines a "best-fit" line through a scatter plot of the datasets, together with a coefficient of determination, usually denoted r2 or R2. When only two variables are included in the regression, R2 is merely the square of the correlation between the two variables. R2 is a number between 0 and 1 that indicates how well one variable can be used to predict the value of another. A value of 1 means perfect correlation, while a value close to 0 indicates a weak relationship between the variables.

A constellation is a pattern created by linking the apparent positions of stars as seen in the sky from Earth. (Astronomers, in technical contexts, usually refer to these as asterisms, reserving "constellations" for the 88 regions into which the sky is divided, each named for the most prominent asterism it contains, although "constellation" is used informally in place of "asterism" by even seasoned astronomers.) Different civilizations have recognized different constellations, and one could create their own constellations by connecting assorted points, the way Randall connected points in his plot to make "Rexthor."

In this comic, a set of data has had linear regression and some form of statistical analysis applied to it, indicating that there is low correlation between the two. The data points are so widely scattered that (as noted in the comic)

it is easier to connect the data points in a constellation-like pattern than it is to determine whether the correlation is negative or positive (without looking at the trendline, of course). Because of this, Randall suggests we should be suspicious of any conclusions drawn from this data.

The comic is somewhat misleading, since the data in the graph actually has an R2 of 0.02, only a third of what Randall claims. An example of published research with an R2 of 0.06 where the association in the graph is noticeable (if not strong) can be found here (figure 2 has r = 0.25 which corresponds to R2 = 0.06). In addition, it is hard to see the association in the comic's graph because relatively few points are plotted. In a data set with 1000 observations and R2 = 0.06, any association between the two variables would be quite clear.

The lines connecting the stars in this "constellation" create a crude illustration of a person with an outstretched arm holding up a dog, which could be a reference to the film Life is Beautiful where a waiter carries a dog on his tray without realizing. The name "Rexthor the Dog Bearer" spoofs the fact that numerous Greek-derived constellation names have both a proper name and an epithet (for example, "Orion, the Hunter"). The fact that "Rex" is an archetypal dog name (but also meaning king as in king of the dinosaurs Tyrannosaurus rex), adds to the humor.

The 95% confidence interval in statistics is such a range of an estimate, that it is expected to contain the real value

(the estimated population parameter) 95% of the time. The confidence interval is a standard method to provide evaluation of the estimation error in statistics. On the right panel the resulting estimate seems to be a drawing, so the 95% confidence interval would be a set of drawings, expected to contain the correct drawing in 95% of samples where it is calculated. According to the title text, the interval in this particular sample also includes a cat and a teapot, so we can only make extremely vague statements in order to maintain 95% confidence.

The teapot may be a reference to Russell's teapot, or possibly to the "teapot" asterism in the constellation Sagittarius. Alternatively it is just because the "dog" actually looks more like a teapot than a dog, and Randall noticed this and added it in the title text. In the latter case, the two first suggestions are just another example on how humans see patterns also where there are none to find, like those of pareidolia mentioned in 1551: Pluto.

#1726: Unicode

August 29, 2016

WATCHING THE UNICODE PEOPLE TRY TO GOVERN THE INFINITE CHAOS OF HUMAN LANGUAGE WITH CONSISTENT TECHNICAL STANDARDS IS LIKE WATCHING HIGHWAY ENGINEERS TRY TO STEER A RIVER USING TRAFFIC SIGNS.

I'm excited about the proposal to add a "brontosaurus" emoji codepoint because it has the potential to bring together a half-dozen different groups of pedantic people into a single glorious internet argument.

Explanation

Cueball is a highway engineer that has been placing two traffic signs in a river trying in vain to guide the water flow and thus he ends up talking to the water trying to make it take a detour instead of going under the bridge. On the distant bank two other engineers are arguing, with gestures, in presumably a heated manner (probably about where to place a third sign, lying next to them on the bank, to make it behave a certain way)

As rivers flow according to the landscape, this plan will not work and the river will continue on its course. Cueball is very frustrated by this and is still trying to make the river obey the traffic laws. The caption lays out the punchline: The comic compares the useless approach of Cueball attempting to divert a flowing, moving river with fixed signs that do nothing, with the Unicode Consortium's attempt to define the diverse and ever-changing human language with strict technical standards.

Unicode is a largely successful attempt to have a standard for representing all possible letters, numerals, digits and symbols that make up human writing in all languages. This includes the roman letters used in this article, characters with modifiers like ê (both with the common characters as well as the modifiers selectable separately), logographic characters like in Chinese, syllabic writing system like Japanese, right-to-left and/or top-to-bottom writing systems, mathematical symbols and many other

writing systems.

Emoji, one of the trendier and newer Unicode blocks, are also referenced in the title text (see below). The symbols on the signs in the river are real road signs, but interestingly enough they also both exist in Unicode, with the warning sign triangle with an exclamation mark having code (U+26A0) and the black, rightwards arrow having code (U+271A). As can be imagined, coping with the wide variety of character sizes, orientations, ways they can be modified, capitalization rules, etc. can get to be very challenging as the Unicode Consortium tries to write rules that accommodate how printed language is actually used. Emoji have become a recurrent theme on xkcd.

The title text refers to a proposal to add three dinosaur heads to the official list of emoji.

This is likely to stir a glorious internet argument between a half-dozen opposing (and pedantic) camps that may now be brought together, such as the following:

- Those who favor the inclusion of more emoji vs. those who oppose emoji on principle.
- Those who accept the existence of Brontosaurus vs. those who deny its status as a genus unique from Apatosaurus.

Randall has made it clear what he believes in 636: Brontosaurus.

Although it seems new development has occurred since

the release of that comic, suggesting that Brontosaurus is a specific genus. But that is still debated...
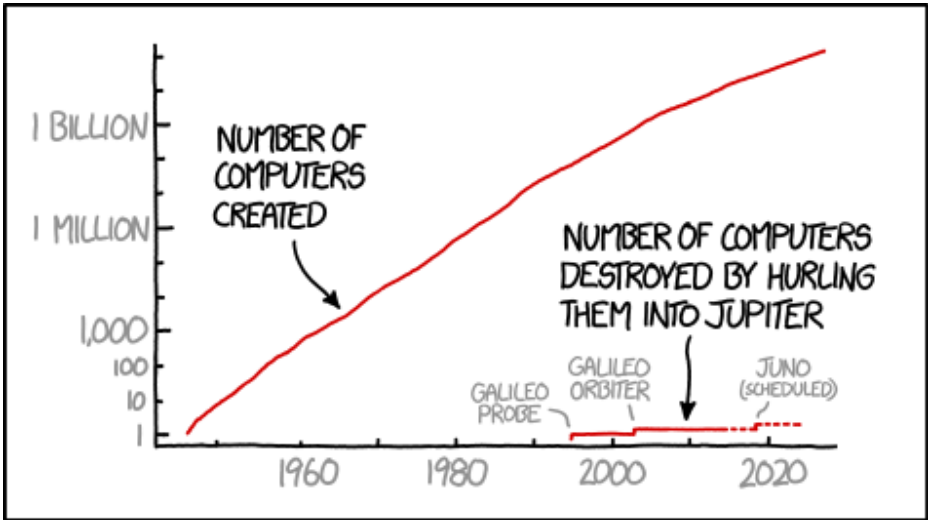
- Those who favor a traditional, scaly image of dinosaurs vs. those who have accepted the feathered-dinosaur paradigm.
- Those who want Brontosaurus depicted as an ordinary or shrinkwrapped sauropod vs. Those who want it depicted with extra soft tissue, especially the heavy neck padding thought to be used for elephant-seal-like duels (the "Brontosmash" hypothesis).
- Those who prefer a different dinosaur species be included instead.
- Those who oppose about the possible inclusion of pterodactyls, which are not considered to be dinosaurs.
- Those who point out that two of the dinosaurs in the "Jurassic Emoji" set actually come from the Cretaceous period, and as such renaming is necessary vs. those who think that "Jurassic" is a cooler word (because of the Jurassic Park movies).
- Those who will use it as a generic emoji for dinosaurs vs. those who insist it must be used for brontosauruses only.

See also this discussion about this comic on the Unicode mailinglist...

Highway engineers were also the subject of 253: Highway Engineer Pranks and 781: Ahead Stop.

#1727: Number of Computers

August 31, 2016

NUMBER OF COMPUTERS CREATED

NUMBER OF COMPUTERS DESTROYED BY HURLING THEM INTO JUPITER

GALILEO PROBE

GALILEO ORBITER

JUNO (SCHEDULED)

NASA NEEDS TO PICK UP THE PACE IF THEY EVER WANT TO FINISH THE JOB.

They try to pad their numbers in the annual reports by counting Galileo's redundant systems as multiple computers, but they're falling behind badly either way.

Explanation

This comic shows a semi-log plot with two red lines. The first line shows the increasing rate that computers have been created since the first came around in the 1940s. The graph shows this to occur around 1946. (The precise date can be discussed but it was around that time that the concept began to be applied to real working machines.) After the first computer, the number of computers created is shown to increase in a roughly straight line, indicating exponential growth. At the time of this comic's release in 2016, the curve has passed 10 billion computers, and its projection into the 2020s predicts that the number of computers will keep rising exponentially for at least 10 years to come.

The other plot on this graph represents all the computers destroyed by throwing them into Jupiter. So far this is only true for the computers on two space probes: those on the Galileo orbiter and its probe. The latter's mission was to fly into Jupiter so it went first in 1995; the orbiter went only after it had completed its mission in 2003. That constitutes the first two steps on the graph.

Recently the Juno space probe entered into orbit (as only the second after Galileo), and that was celebrated with 1703: Juno on xkcd. Juno's main mission has hardly begun yet; as at the time of this comic's release, it is not even in its final orbit. But once its mission is completed, it will also crash into Jupiter thus destroying a third computer. This is shown as the third step, but this

section is shown with a dotted line, as the destruction may still fail if NASA loses contact with the probe before giving it the order to deorbit into Jupiter. This is now scheduled to occur in 2025. All three steps on the graph fits with these years. (Note the number of computers created is not drawn with a dotted line into the future, probably because Randall believes this continued increase in numbers of computers to be quite certain over the next 10-20 years, whereas the outcome of a space probe mission is never certain, even when the probe is already in orbit and only 1½ years before scheduled deorbit!)

Space probes sent to Jupiter are typically scheduled to deorbit and fall into Jupiter's atmosphere. There can be several reasons for this, but one very important reason is to avoid contaminating Jupiter's moons with Earth pathogens, especially the four Galilean moons including Europa which may harbor life. Also the huge gravity well of Jupiter that would have to be overcome for such a probe to leave the planet again makes it impossible to have an orbiting probe return to Earth with samples.

The caption below the comic humorously implies that NASA's reasons for causing the probes to deorbit into Jupiter is merely an attempt to destroy all the computers of the world. The caption notes that they are failing horribly, given that they have destroyed only three computers out of more than 10 billion. However, due to the semi-log scale, those three computers appear to have more significance than they actually have. The caption states that NASA really needs to pick up the pace (having
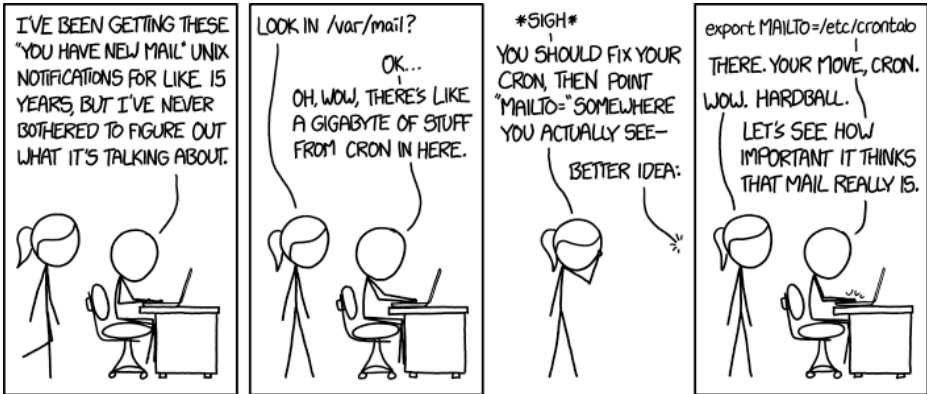
only destroyed two since the 1940s, when computers were created), if they wish to actually finish the job of destroying all computers by hurling them into Jupiter. In addition, seeing as there have been many computers destroyed by other means, NASA will never actually catch up, no matter how hard they try, making this statistic even more irrelevant.

Destroying unwanted objects by hurling them into Jupiter pokes fun at the common science fiction trope of destroying objects by hurling them into the Sun . Hurling objects into the Sun is in fact extremely difficult because of the need to cancel out the orbital velocity of the earth. Randall may be referencing calculations (, see item 11) that show that hurling items into Jupiter requires 38% less energy than hurling them into the Sun.

The title text continues the caption by mentioning that in NASA's annual reports they try to make their numbers look better by counting the redundant computer systems on Galileo and its probe, thus doubling the numbers of destroyed computers to four. This of course makes no big difference given the exponential growth of computer production, which is also noted. This indicates that this is a top priority for NASA. That NASA might try to make themselves look better in a report by doubling a number could be realistic, presumably for political reasons or to get better funding.

#1728: Cron Mail

September 02, 2016

I'VE BEEN GETTING THESE "YOU HAVE NEW MAIL" UNIX NOTIFICATIONS FOR LIKE 15 YEARS, BUT I'VE NEVER BOTHERED TO FIGURE OUT WHAT IT'S TALKING ABOUT.

LOOK IN /var/mail?

OK...

OH, WOW, THERE'S LIKE A GIGABYTE OF STUFF FROM CRON IN HERE.

SIGH

YOU SHOULD FIX YOUR CRON, THEN POINT "MAILTO=" SOMEWHERE YOU ACTUALLY SEE—

BETTER IDEA:

export MAILTO=/etc/crontab

THERE. YOUR MOVE, CRON.

WOW. HARDBALL.

LET'S SEE HOW IMPORTANT IT THINKS THAT MAIL REALLY IS.

Take **THAT,** piece of **1980**s-era infrastructure I've inexplicably maintained on my systems for **15** years despite never really learning how it works.

Explanation

On Unix-like systems, cron is a system utility that runs tasks on a schedule. This program has been around since the early days of Unix and has not changed much - it is still one of the most widely used functions in modern operating systems. Many administrative tasks on servers are automated using cron, including monitoring and updates.

When a cron job produces output, cron's default behavior is to send an email to the user account under which the job ran. However, in most situations, an email address has not been set up for that user, so the email is instead written to a mailbox file. Most Unix shells will notify the user with a message like "You have new mail" when this mailbox file is updated, but if the user doesn't know how to check this mail file, they will likely just ignore the message.

In this case, Cueball has been ignoring his mailbox for fifteen years. When he finally learns where to look, he discovers more than a gigabyte worth of messages from the cron program, the vast majority of which are likely meaningless. Ponytail says to Cueball "fix your cron" (likely meaning he should fix the task that's generating the output so that it doesn't do so), then set a parameter that tells cron to send email to an address he actually checks. (He could also opt to direct the mails to /dev/null, which would discard them, or simply disable the mail in the crontab.) Cueball, however, interprets

the tremendous amount of email as spam and decides to redirect the emails to /etc/crontab, the main configuration file that contains all of cron's scheduling information. He apparently believes that this will either stop the emails or cause cron to spam itself instead.

In reality, this will not cause significant problems as the MAILTO environmental variable in cron takes an email address or usernames on the local system and attempts to send emails to them. It will not write or append output to a local file like /etc/crontab. Thus when cron attempts to email /etc/crontab the mail program cron uses will generate an error saying it can't find the user /etc/crontab.

For example, if you create the following crontab:

installed on a user named me on a system called mycomputer then you will see a new error messages email to you (located in /var/mail/me) stating it can't send email to a user named /etc/crontab and the undelivered email is being returned to the sender. The error email will look like the following:
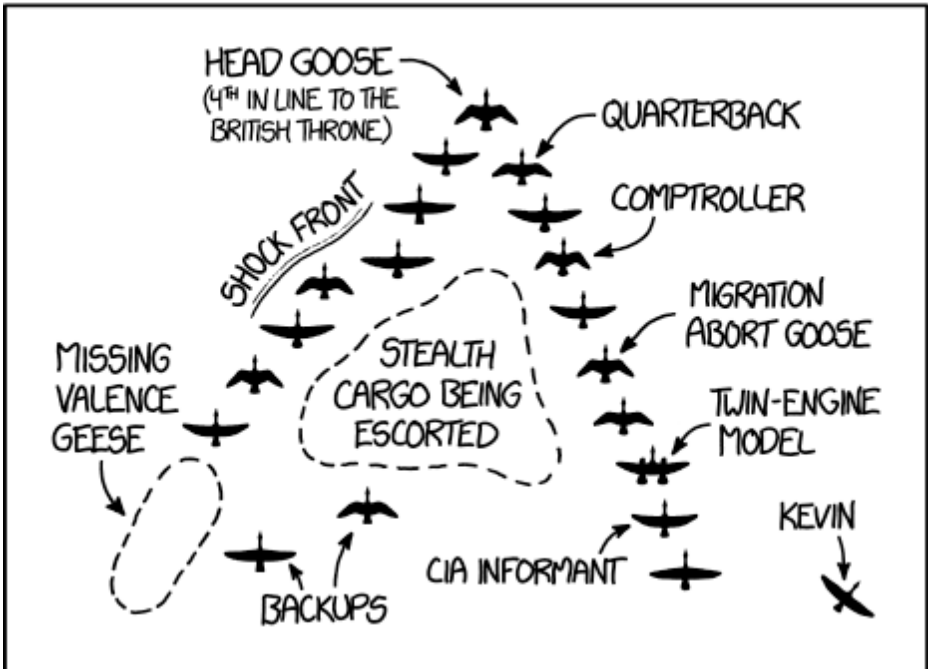
The title text shows that Cueball is somewhat aware of what cron does, including the fact that it's existed pretty much unchanged for several decades, but he hasn't bothered to really get into understanding it, treating it more as a foe to vanquish rather than as a tool to understand and use.

#1729: Migrating Geese

September 05, 2016

"Hey guys! I have a great idea for a migration!" "Dammit, Kevin."

Explanation

Migrating refers to the changing of a habitat, which happens every year with birds like geese that travel long distances to avoid cold seasons and get back to the food in the summer time. When geese fly to their new habitat, they tend to fly in a very clear V formation. The V formation improves the efficiency of flying birds, particularly over long migratory routes. All the birds except the first fly in the upwash from one of the wingtip vortices of the bird ahead. The upwash assists each bird except for the "leading" one in supporting its own weight in flight, saving them up to 20% of the energy needed.

It should be noted that geese do have family structures with adult geese in "alpha" positions, but not a strict ranking order. An individual's position in formation flights is coincidental and constantly changing, so that the goose at the point of the formation can pull back and rest in the V wings while others "lead" the skein. Popular earlier beliefs about an "alpha goose" heading a formation for the entire flight is a myth, easily disproved by watching geese formations in flight.

This comic shows such a formation with 20 geese, with several geese and areas in the V formation labeled, giving different roles to the geese and assigning these areas a new meaning. See the table below.
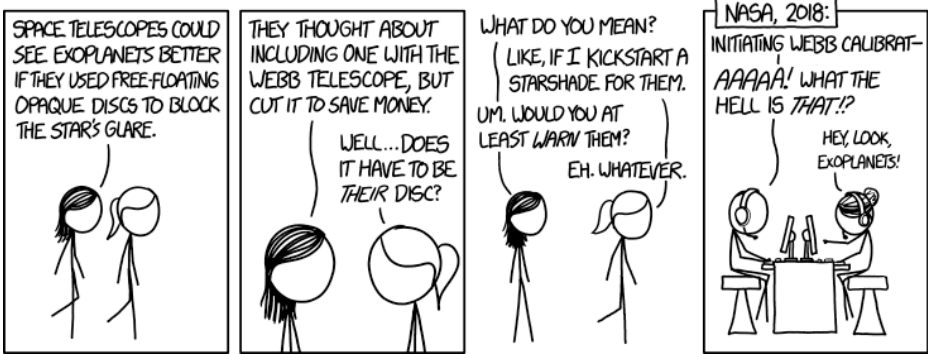
Apart from a "twin engine" goose in the bottom right arm of the V the only part of the formation that would

not normally be seen is Kevin, who flies off at a 45-degree angle. In that direction there is no aerodynamic help from the other birds, and in the title text the rest of the geese also exclaim, "Dammit, Kevin" when he (again?) tells them that he has a great new idea for a migration (maybe referring to the new direction). This is either a reference to the fact that migrating birds manage to consistently arrive in the same general area every year, or to the way that vacations are sometimes suggested (by humans): "I thought of an idea for a vacation..." This was only the second time the name Kevin was used in xkcd for a fictive person, see more in this trivia.

Table of labels[edit]

#1730: Starshade

September 07, 2016

Panel 1:
SPACE TELESCOPES COULD SEE EXOPLANETS BETTER IF THEY USED FREE-FLOATING OPAQUE DISCS TO BLOCK THE STAR'S GLARE.

Panel 2:
THEY THOUGHT ABOUT INCLUDING ONE WITH THE WEBB TELESCOPE, BUT CUT IT TO SAVE MONEY.

WELL...DOES IT HAVE TO BE *THEIR* DISC?

Panel 3:
WHAT DO YOU MEAN?

LIKE, IF I KICKSTART A STARSHADE FOR THEM.

UM. WOULD YOU AT LEAST *WARN* THEM?

EH. WHATEVER.

Panel 4:
NASA, 2018:
INITIATING WEBB CALIBRAT—
AAAAA! WHAT THE HELL IS *THAT!?*

HEY, LOOK, EXOPLANETS!

The New Worlds Mission is already trying to get funding for this, but NASA sponsored their proposal, so it will be hard to catch the telescope people by surprise with it.

Explanation

Megan (drawn to look similar to Danish) and Ponytail are talking about space telescopes in general. Megan says that these telescopes could see exoplanets better by using occulting disks, in the form of free floating opaque discs, that could block out light from the exoplanets' stars, thus enabling the telescopes to see the weak light from the planets when the glare of the stars has been diminished.

She continues by explaining that the scientists behind the new James Webb Space Telescope, at the time of the comic scheduled to launch in 2018, thought about including such a disk (a starshade), but that it was cut for budget reasons. Ponytail asks if it has to be their own disk, and then decides to kickstart a fundraiser to build a starshade. Ponytail is referring to the crowdfunding site Kickstarter, although there is no actual project for a starshade for Webb (or for the New Worlds Mission; see title text explanation) on Kickstarter. Megan asks her to at least warn the scientists if she makes the starshade, but Ponytail just replies "whatever".

The final panel shows the NASA control center in 2018 when the Webb telescope is being calibrated. It turns out that Ponytail succeeded and did indeed not warn the scientists. Cueball is surprised by the disc -- presumably because an unfamiliar object suddenly eclipses the star and possibly even seems to "eat" the star -- but Hairbun immediately notices exoplanets, implying that Ponytail's plan worked.

Note that the telescope has partners from 20 countries and is being operated not only by NASA but also by European Space Agency (ESA), Canadian Space Agency (CSA), and the Space Telescope Science Institute (STScI).

The best known space telescope is the Hubble Space Telescope, which was launched back in 1990. The Webb telescope is seen as a successor instrument to Hubble and, because its instruments are designed to work primarily in the infrared region of the electromagnetic spectrum, also as a successor to the Spitzer Space Telescope launched in 2003. In addition to having more sensitive sensors and being larger, Webb will also be located near the L2 Earth–Sun Lagrangian point, and thus not in orbit around Earth. This means that it can keep focusing on a specific point for longer times, while Hubble can see a given point for only about half an hour before moving behind Earth again. When operating in the infrared range as the Webb telescope does (from middle infrared to red and orange visible light), it is important to be outside the atmosphere or at least on very high mountains. Another important feature is to keep the temperature constant and very cool. Since the Webb telescope is always in the light of the sun, this is achieved using protection from a large sunshield.

The title text mentions the New Worlds Mission. This mission is to find exoplanets (hence the name New Worlds) by applying a starshade to block the light of distant stars, so that the planets around the stars are more visible. All discovered exoplanets so far have been found

indirectly and not by direct visual observation. The starshade proposed by the New Worlds Mission is a spacecraft designed to work in tandem with a space telescope (not necessarily just the Webb telescope). It is a large occulter that blocks a star's light. One problem with this concept is that light coming from the target star would diffract around the disc and constructively interfere along the central axis. Thus the starlight would still be easily visible, making planet detection impossible. In order to avoid this problem, the proposed starshade is a sunflower-shaped coronagraph disc. The "petals" of the "sunflower" shape are designed to eliminate this diffraction, making exoplanet observation possible. The starshade would fly 72,000 km (45,000 mi) in front of a space telescope (between the telescope and a target star) in order to work. A video demonstrating the starshade is available on the Wikipedia page for the New Worlds Mission. The title text explains that NASA actually sponsored this mission's proposal to build a starshade for the Webb telescope, and concludes that the surprise shown in the comic is not likely to occur in real life. NASA stopped this sponsorship in 2008, and the New Worlds Mission has been looking for additional financing since 2010. Telescope people refers to the engineers and scientists who build, operate, and use space telescopes.

It seems clear that Randall would like to point attention to the New Worlds Mission, possibly hoping for increased funding for the project so a starshade could become a reality for the Webb telescope. That Randall is

interested in exoplanets has been demonstrated many times in xkcd.

Note that two of the Webb telescope's instruments, the NIRCam and the MIRI, feature starlight-blocking coronagraphs for observation of faint targets such as exoplanets, so the telescope has ways to improve the visibility of these planets. However, Randall (and the New Worlds Mission) believe that a starshade would be better suited for this task.

The idea of an occulting telescope was used in 975: Occulting Telescope, where it turns out the purpose is to just block all star light, not to see exoplanets.
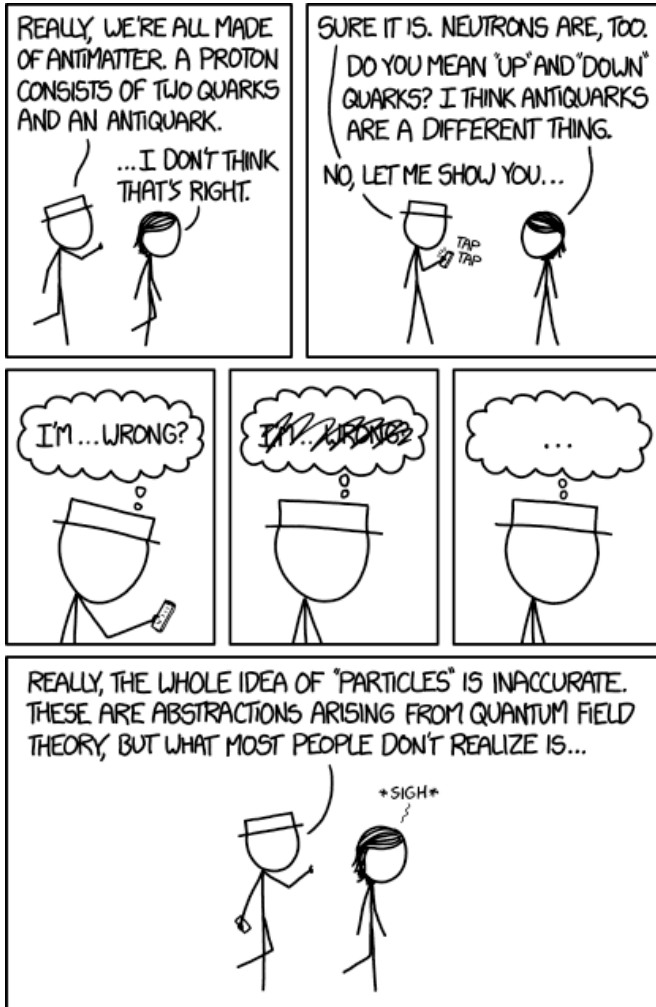
Hang on, I just remembered another thing I'm right about. See...

Explanation

All matter that we encounter in everyday life is normal matter and not antimatter. Atoms, while once when they were named believed to be the smallest unit of matter, are now known to be made up of protons, neutrons and electrons. Protons and neutrons are in turn made up of quarks, which are fundamental particles (meaning not made of other particles). Quarks come in six different "flavours" (up, down, top, bottom, charm, and strange), with protons and neutrons being made of up and down quarks. Each flavour also has a corresponding antiparticle, an antiquark, which would make up antiprotons and antineutrons.

White Hat and Megan appear to be discussing the topics of antimatter and subatomic particles. White Hat makes the assertion that we (referring to people and objects) are made partially of antimatter, because, as he claims, a proton (one of the particles which make up all matter) is made of two quarks and an antiquark. In fact, protons are made up of two up quarks and a down quark, which are all not antiquarks. He is likely making the mistake of mixing up the "up" and "down" flavours of quarks (which can be seen as complementary flavours of quarks) and mistaking them to be mutual antiparticles. He continues to elaborate on his idea by mentioning neutrons, which are made of two down quarks and an up quark.

When Megan (accurately) doubts his claim, White Hat

takes out his smartphone to look it up, in order to show Megan that he is correct. However, upon researching online, he realizes that he was, in fact, wrong (hence the title of the comic). Not wanting to admit being incorrect or yield his position in the discussion, he convinces himself that he wasn't actually wrong, as depicted by his mentally erasing the realization that he was wrong. Instead, he completely changes the topic to try and re-frame it so that he is not wrong. In this case, he circles back and criticizes the entire scientific concept of "particles", which can be seen as an attempt at a straw man on his part. Presumably, he will go on to explain how humans are not made of particles and quarks, but of waves.

It is rather common to be unwilling to admit fault (the whole topic of this comic) and to instead try to maintain an air of infallibility and intelligence. Some people are just too prideful to admit that they are inherently fallible. White Hat is one of those people, as depicted in several of his earlier appearances (see trivia section). Randall uses this comic to criticize people who are unable to put aside their ego and re-assess what they know in the face of empirical data. Such thinking flies directly against scientific rigor (adding an extra layer of irony to the situation, since White Hat and Megan are discussing a scientific topic). This method had already been called wrong in 803: Airfoil.

White Hat's new topic, where he can be right, includes the quantum field theory, a very complicated field, which it is likely one Megan is not well versed in (inferred

by the fact that she was not quite sure about the anti-quarks). So he may be raising the topic because he believes she will not understand it sufficiently to refute his correctness. Megan, however, recognizes exactly what he is trying to do, and can only sigh in response to his failed efforts. In the QFT, particles are often described as resonances or excited states of the underlying physical field, in the same way as photons may be thought of as excitations in the electromagnetic field; in this way White Hat appears to be dismissing his earlier errors by implying that particles are merely an effect of something more complex, of which he can demonstrate his knowledge. Furthermore, in quantum field theory quarks do not exist in the conventional sense.

In the title text, White Hat just remembers another thing he's right about. This demonstrates even more clearly that he is not interested in a discussion on the merits of a topic, but instead is seeking only recognition and validation for being right. This bears some similarity to 386: Duty Calls, in which Cueball stays up late correcting someone on the Internet, and 2051: Bad Opinions, where Cueball actively seeks out people with bad opinions for him to correct.

White Hat may have incorrectly remembered that, while the valence quarks in a proton are all matter, quantum field theory says that protons also contain an indefinite number of "virtual" anti-quarks, quarks, and gluons. See this video What are Quarks? about this. His final comment could be referring to the ontological debate over whether virtual particles are in some sense real or

only an artefact of perturbation theory. Alternatively, he may have been confused by the fact that negatively charged quarks contribute negatively to baryon number. <!-- I think that that's incorrect; could you be thinking about strangeness and bottomness instead? I'm not wrong, but let's talk about something else that I'm right about instead. -->

#1732: Earth Temperature Timeline

September 12, 2016
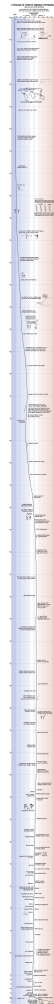
[After setting your car on fire] Listen, your car's temperature has changed before.

Explanation

This comic is a timeline on how the temperature has changed from 20,000 BCE (Before Common Era) to the present day (2016), with three predictions for the rest of the 21st century depending on what actions are taken (or not taken) to stop CO_2 emission. This comic is a direct, but much more thorough, follow up on the previous global warming comic: 1379: 4.5 Degrees. By having readers scroll through millennia of slow-paced natural changes, Randall uses the comic to confront the rapid temperature rise in recent years.

Over the past 100 years, human action has produced a large amount of CO_2 emissions, which have caused a rise in average global temperature through the greenhouse effect. This is called global warming and is part of a climate change, a subject that has become a recurrent subject on xkcd. There are still many people who claim that this is not happening, or at least that it is not caused by any human actions, called climate change deniers. One argument of theirs is that global warming is happening for natural causes, summarized with the phrase "temperature has changed before".

This comic shows that while temperature changes have indeed occurred before, the speed of the current temperature rise is much, much faster than those measured for many previous thousands of years. The comic became so popular that Randall postponed the release of his next comic to keep this one on the front

page one day longer.

The temperature curve is a dotted line most of the time, but from about 1850 to 2016 the measurement data is good enough to let the curve become a solid line indicating that this is not an estimate. Before 1850 the temperature is an estimate based on the sources given. And likewise into the future the three possible curves are also dotted to show that they are predictions, based on how seriously the population of Earth takes knowledge (and comics) like this.

Although this is a topic Randall obviously takes very seriously, and by far most of the facts fit with known history, he still includes several jokes in the comic. See also the table explaining each item in the comic.

The title text compares the saying that "the temperature has changed before" comparing temperature changes over thousands of years to the rapid global warming over the last century with saying that the "small" changes to the temperature a car experiences over the years of normal usage should not make you worried over the rapid temperature increase that happens when someone sets your car on fire. Randall previously used this joke in 1693: Oxidation and 1014: Car Problems.

Jokes in the comic[edit]

- By placing the invention of the internet at 1980 in the chart, just where the temperature curve starts its most rapid increase, Randall humorously implies that the internet caused the rise in temperature.

- At 13600 BCE a glacier is shown retreating from New York because of the warm up. It is disgusted by the new changes and proclaims: That's it! I'm moving to Canada! This is a joke on an idiom said by US citizens to protest against changes in their country. As shown in the chart, the glacier takes 5000 years (13600-8400 BCE) to cross what would become the Canadian border (neither the United States nor Canada existed yet).[citation needed] Also, glaciers don't speak English, or any language for that matter.[citation needed]

- At 13400 BCE it is mentioned that humans domesticate dogs. Megan talks to a wolf about to be tamed making a deal with it, that it can eat and sleep with the humans as long as they can yell at it for pooping indoors. This sounds like a sweet deal for the wolf until Cueball mentions that they will breed it to be very small and then dress it up in small costumes. The wolf says wait, but it is already too late...

- The Pokémon reference at 9000 BCE about them going extinct in North America (although Megan, immediately underneath, does note that this is not a real fact). As the writing stated that Pokemon go extinct this can also be seen as a reference to a popular video game called Pokémon Go and hence also the comic 1705: Pokémon Go.

- At 4500 BCE, next to "Proto-Indo-European language develops", Ponytail gets the idea to develop the language heavily inflected to make it difficult to remember all the verb endings for future students. This is a direct reference to the comic 1709: Inflection.

- The reference to the 1984 mockumentary about the fake rock band This Is Spinal Tap in conjunction with Stonehenge at 2200 BCE. In the movie the band ordered a giant 18 feet

Stonehenge megalith but a writing mistake gives them one that is only 18 inches high.

Another real band Nine Inch Nails is referenced 15000 BCE where Megan writes the band's stylized name NIИ on the wall next to Hairy who is in the process of painting the cave painting at Lascaux in France.

- Around the setting of the Iliad and the Odyssey (1200 BCE) a drawing of the Trojan Horse has writing on it that states: Not a trap.
- Just below the previous entry also at 1200 BCE is the mentioning of the invasion of the Sea Peoples. This sounds so much like a reference to mermaids, often called sea people that Randall feels the need to note that this invasion and these sea people is a real thing in a footnote. This is opposed to the Pokémon reference above where he notes that it is not a real fact. The sea people was a seafaring confederation of groups known to have attacked ancient Egypt and other Bronze age civilizations around this time. It is widely regarded to be one of the major causes of the Bronze Age Collapse.
- The reference at 450 BCE compares the Battle of Thermopylae (also known as 300 Spartans) with the dramatized 2007 movie 300, but in the real world the fighting of course occurred at regular speed and with more clothing.
- There are other minor jokes but this list mentions all the major jokes.

Table of all elements[edit]
- Here is table including all elements in the chart with explanations including reading off temperature and year for

each event from the curve.

The year group is just an easy way to find the section.

Element is a description mainly taken from the transcript.

The actual year of an event has been read off more precisely on the chart.

The central part of the element has mainly been used.

Only rarely has ranges below 100 years been used but if a location is clearly midway between two hundred years intervals 50 year range has been used.

Only when there are several posts close to each other has smaller range been used a few times.

T (°C) is the number of degrees Celsius above or below the 1961-1990 average, which on this graph is set to zero, (i.e. not the number of physical degrees above or below this 0°C).

These have been read of to 0.1°C rounding up or down. Lines have been inserted over the chart, 10 for each degree, to make this as accurate as possible.

In a few cases where a maximum is reached 0.05°C has been used

Explanation of each element.

Sources[edit]

The image attributes climate data sources as "Shakun et al. (2012), Marcott et al. (2013), Annan and Hargreaves (2013), HadCRUT4, IPCC":

• Shakun, Jeremy D.; Clark, Peter U.; He, Feng; Marcott, Shaun A.; Mix, Alan C.; Liu, Zhengyu; Otto-Bliesner, Bette;

Schmittner, Andreas; Bard, Edouard (2012-04-04). "Global warming preceded by increasing carbon dioxide concentrations during the last deglaciation" (PDF). Nature. 484 (7392): 49–54. doi:10.1038/nature10915. ISSN 1476-4687. Archived from the original on 2016-05-20.

- Marcott, Shaun A.; Shakun, Jeremy D.; Clark, Peter U.; Mix, Alan C. (2013-03-08). "A Reconstruction of Regional and Global Temperature for the Past 11,300 Years" (PDF). Science. doi:10.1126/science.1228026. Archived from the original on 2013-04-12.

- Annan, J. D.; Hargreaves, J. C. (2013-02-13). "A new global reconstruction of temperature changes at the Last Glacial Maximum" (PDF). Climate of the Past. 9 (1): 367–376. doi:10.5194/cp-9-367-2013. ISSN 1814-9324. Archived from the original on 2020-07-28.

- HadCRUT (Hadley Centre/Climatic Research Unit Temperature) - Official site

- Intergovernmental Panel on Climate Change - Official site

September 15, 2016
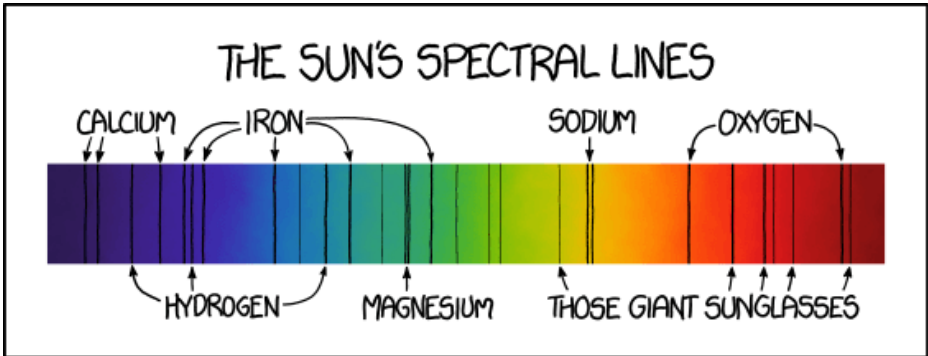
I still don't understand why the Sun paid the extra money for Transitions lenses.

Explanation

This comic's release day was postponed from the scheduled Wednesday release to a Thursday release because Randall noticed the extreme popularity of the previous comic on Monday: 1732: Earth Temperature Timeline. Randall even explained this in the header text; see this trivia item from the previous comic.

This comic depicts the Fraunhofer lines, i.e. the spectral lines seen when sunlight is split in a spectrometer. These appear as black gaps in the rainbow of light, caused by light being absorbed by elements in the Sun. The frequencies of light that an atom absorbs depend on the exact arrangement of electron orbitals around it - because each element has a different pattern of orbitals, each one has a distinctive pattern in the absorption spectrum. The chart shows most of the main lines in the visible spectrum and identifies the elements linked to them.

The image of the Fraunhofer lines from Wikipedia is shown below in the section with a table of these lines. Here it can be seen that all the lines that are labeled with elements are correctly labeled. Also all lines shown in the part of the spectrum included in the comic are included. Ten of the lines included are not labeled in the picture on Wikipedia (at least not with an element; two of the three "h" labels are not in the table on Wikipedia). Six of these also have no label in the comic. The other four lines' label Those giant sunglasses constitutes the joke of the comic. There seems to be only one clear error in the comic and

that is the fifth line labeled Sunglasses, the middle of the lines, which is actually a Hydrogen line (C in the picture below). But the line next to it to the right is one of those not labeled in either picture and it seems likely that it was this line Randall meant to be a Sunglass line...

All ten extra lines (including both the labeled and unlabeled ones) seem to correspond to the spectrum of silicon, and the joke then refers to the silicon dioxide (aka glass) used in the lenses of the Sun's sunglasses. Of course, this means that the glasses have been ionized and turned into plasma by the heat of the sun.

The idea of a sun with sunglasses is a reference to pictures/clipart of the sun wearing sunglasses, often used to denote good weather. Randall has specifically used this picture in at least two what if? articles:

So this comic is a direct callback to this what if? post.

There is another joke in drawing a sun with sunglasses because sunglasses are meant to protect your eyes from the sun, so what should they protect the Sun's eye from, Star light...? Also, any glasses worn by the sun, would they not become sun glasses?

Transitions® is a brand of photochromic lenses; however, photochromic lenses are often referred to as "transition lenses", so the title text does not necessarily refer to the brand. Photochromic lenses are a type of plastic lens used in prescription spectacles that allow the lens to turn dark when exposed to UV light such as that

found in sunlight. The sun choosing to get transition lens would prove a waste of money as the lenses would be permanently transitioned to be dark, so a pair of ordinary sunglasses would likely have proved more cost effective. (Always assuming they do not turn into plasma when getting close to the sun...)

Table of spectrum[edit]

- In the table below are the official labels from the picture above. If there are no label this is noted with none.

Note that they are labeled from right to left!

- Then the element causing the line is mentioned. Unlabeled is used if the line is not mentioned in the table from Wikipedia.
- Then follows the wavelength. It is given with decimals if it is noted in the table from Wikipedia. Else it has been read off manually from the picture above.
- Then follows the label given in this comic, with unlabeled meaning that it is not labeled in the comic but still shown.

If the line is not even included in the xkcd comic "N/A" will be used.

A number will be given after the xkcd label listing which number line on xkcd that has used this label. (Note going from left to right in the numbering).

- Finally a comment can be made on this.

If the two labels fit, then agreement is noted.

September 16, 2016

REDUCTIONISM • *n.* 1. "R" IS A LETTER WITH ORIGINS IN EGYPTIAN HIEROGLYPHICS. "E" STANDS FOR A VOWEL SOUND NORMALLY REPRESENTED BY "I" UNTIL THE 1500's "D" IS

"I've noticed you physics people can be a little on the reductionist side." "That's ridiculous. Name ONE reductionist word I've ever said."

Explanation

Reductionism is an approach that seeks to understand the world by breaking problems into simpler pieces. This approach can disregard emergent properties which appear only from the individual parts working together.

In this comic Randall shows the first part of a dictionary entry on the word Reductionism. In a real dictionary like Dictionary.com an entry with similar build up looks like this:

In the comic the n refers to noun and the "1." indicate that this is the first of more than one entries about the word.

The meta joke is that Randall is attempting to define the word reductionism by taking the reductionist approach to its extreme. He thus breaks the word into its 12 individual letters explaining the origin of each individual letter, acting as if the word was nothing more than the "sum" of all its letters. In doing so he entirely fails to explain the actual meaning of the word. (Maybe a reader could guess the meaning based on how the entry is written... or maybe the whole dictionary is written like this, making it practically useless.)

The entire entry number 1. could in principle have 12 phrases one for each of the letters R, E, D, U, C, T, I, O, N, I, S and M, but here only the first two for R and E are included, the third (D) only just starts when the entry is

cut off at the bottom of the panel. It could be argued that the two I's could share one explanation, but as a reductionist you might not even notice that the I had already been explained.

As it happens, every letter of the Latin alphabet (the writing system used by the English language and many other languages) is ultimately derived from Egyptian hieroglyphics, not just "R". But maybe the same sentence is used for all the consonants as the only word in the explanation for "D" is "is"; the same that starts the explanation for "R".

The second letter that is explained is "E", a vowel. In modern English spelling, the letter "E" is used – alone or in combination – to represent a number of different vowel sounds (compare "gene", "bed", "crepe"). In the word "reductionism", the "E" can be pronounced as /ɪ/ ("rih"ductionism), /iː/ ("ree"ductionism) or /ə/ ("ruh"ductionism), depending on dialect and emphasis, but the comic is talking about the sound used to pronounce the letter itself, /iː/ ("long E"). It explains that this vowel sound was normally represented with the letter "I" until the 1500's. This is a reference to the Great Vowel Shift, a change in the pronunciation of many English vowels around that time. Before then, a word like "see" was pronounced /seː/ (approximately "seh", with no diphthong), while a word like "bite" was pronounced /biːt/ ("beet"). So in modern English pronunciation, the "long E" sound is the same as what the "long I" spelling used to represent.

In the title text, two people are speaking. The first speaker has noticed that "physics people can be a little on the reductionist side". (Randall would consider himself a physicist). The presumed physicist then says that it is a ridiculous notion. He challenges the other to "Name ONE reductionist word I've ever said." But by claiming he is not a reductionist by focusing on the individual words (which, even/especially in the case of "reductionist", are never used solely by reductionists) he is asking for an impossible comparison to be made, when proof of reductionism is clearly an emergent property of a fuller sentences, if not whole discourses. By insisting on focusing only upon individual words in this manner the speaker likely proves themself a reductionist, in the very act of trying to refute this accusation.

Reductionism has previously appeared deep down in 1416: Pixels.

#1735: Fashion Police and Grammar Police

September 19, 2016

FASHION POLICE   GRAMMAR POLICE

THEIR
THEY'RE
THERE

- JUDGEMENTAL AND SMUG
- ANGRY ABOUT SOMETHING DEEPLY ARBITRARY
- STRONG OPINIONS BACKED BY STYLE GUIDES
- APPRECIATE THAT THE WAY YOU ARE INTERPRETED *IS* YOUR RESPONSIBILITY
- UNDERSTAND THAT THERE'S NO WAY TO "OPT OUT" OF SENDING MESSAGES BY HOW YOU PRESENT YOURSELF, AND ATTEMPTS TO DO SO SEND STRONG MESSAGES OF THEIR OWN
- TO SEEM COOL AND CASUAL, PRETEND TO IGNORE THEM WHILE UNDERSTANDING THEM VERY WELL
- VINDICTIVE ABOUT THINGS THAT ARE OFTEN UNCOMFORTABLY TRANSPARENT PROXIES FOR RACE OR SOCIAL CLASS
- FUN TO CHEER ON UNTIL ONE OF THEM DISAGREES WITH YOU

I JUST REALIZED THESE ARE LITERALLY THE SAME PEOPLE.

*Mad about jorts

Explanation

In this comic, two groups of angry protesters are presented and labeled. They are most likely drawn side by side not because they're protesting in the same place, but to compare their similarities.

The left group represents the Fashion Police with Cueball holding a sign implying that Crocs are prohibited by showing Crocs shoe/sandal in a circle with a strike through it. Crocs are clogs made of foam. Crocs (and their imitators) have become fairly popular due to their low price, comfort, and ease of use, but are broadly considered unfashionable to wear in public. It is not the first time Randall mocks a special type of shoes, as previously, in 1065: Shoes, Randall was after shoes that has those creepy individual toes like Vibram FiveFingers. They will also never be a hit with the Fashion Police.[citation needed]

The right group represents the Grammar Police with another Cueball holding a sign with the three homophones Their (belonging to them), They're ("they are", contracted), and There (a location). These words are frequently confused for one another, due to their common usage and identical pronunciation, with one spelling then being used in a context meant for a different one and potentially provoking the Grammar Police to quickly intervene. See the Grammar Police on Twitter and Linguistic prescription.

The two groups look similar, standing in similar poses, with Cueball holding a sign and Megan in the front line in both. Each group also has one member brandishing a sword, indicating the exaggerated level of intensity they feel about their respective causes.

Both types of people will correct, criticize, denigrate or mock those who fail to conform to their criteria for what is "correct". Fashion police oppose people wearing clothing that's mismatched, out of style/fashion, or simply "ugly" to them. Grammar police are "sticklers" for grammar rules and have an immediate negative reaction when someone uses non-standard grammar in a sentence. These two groups are generally seen as socially separate, and their goals appear very distinct, but the comic explains how the two groups are actually very similar. This is demonstrated by listing eight characteristics, plus one in the title text, common to both groups. See explanation in the table below.

In the caption below the comic Randall notes that he had just realized that these are literally the same people because they both exhibit the listed traits.

It seems like a safe assumption that there are more grammar pedants (see title text of 1652: Conditionals) than fashion police people who read xkcd, and it also would seem likely that many xkcd readers would dislike the Fashion Police. This comic may, therefore, be intended to point out to grammar pedants that their behavior is functionally similar to that of other people who they dislike. Ponytail also represented the grammar

police in 1576: I Could Care Less, where Megan puts her in place after she polices her sentence; this thus shows what Randall thinks about such police work and supports the above assumption. In 1576: I Could Care Less, "literally" was also used in the title text.

Randall is, with regards to language, definitely one of those that can belong in this group: To seem cool and casual, pretend to ignore them while understanding them very well.

The title is a ninth point to add to the list, with the asterisk in front representing one more bullet. See the last entry in the table below for more.

#1736: Manhattan Project

September 21, 2016

On the plus side, we definitely killed that cancer over there, even if we caused a bunch more everywhere else.

Explanation

The Manhattan Project was a big, expensive, secret research and development project that produced the first nuclear weapons during World War II. Because of the unprecedented scale of the project, which involved some of the brightest minds in science and the efforts of thousands of people, "Manhattan Project" has become a metaphor for any kind of all-out effort involving the top minds of a discipline to achieve a single objective, often expressed as the phrase "We

need a new Manhattan Project".

The day before this comic was released the following announcement was made: Microsoft will 'solve' cancer within the next 10 years by treating it like a computer virus. And on the day this comic was released (but probably after the comic was released) there was a press conference where Mark Zuckerberg and Priscilla Chan Pledge $3 Billion to Fighting Disease (all disease in general.) These projects hardly approach the scale of the Manhattan Project, but they (at least the Microsoft announcement) could be the reason this comic came out when it did.

In this comic, Ponytail starts by making the suggestion that they should create a "new Manhattan Project" to cure cancer. Taken figuratively, this would imply a heavily-funded, massive collaborative effort involving the best scientists in the field of cancer research, and is not an unreasonable idea in itself. However, she and her fellow

scientists all take the idea literally instead, and the New Manhattan Project ends up actually developing a nuclear bomb. In the final panel, Ponytail appears to realize that this runs somewhat counter to her original objective[citation needed] (not to mention is redundant, as the original Manhattan Project already invented the nuclear bomb).

The title text hastily justifies this mistake by claiming a partial success; that their nuclear detonation did, indeed, kill all cancer within the blast radius of the explosion. However, it fails to mention that the blast would also kill everything else as well. It also admits that the explosion would most likely end up causing more cancer due to the ionizing radiation and fallout. The title text is reminiscent of both the main comic and the title text of 1217: Cells.

This was the first time since 1355: Airplane Message, more than two years prior, that Randall mentions cancer (on a banner!), a recurring subject on xkcd, but mainly around the time when his then-fiancée (now wife) was diagnosed with Stage III breast cancer in October of 2010. Interestingly enough there are only two facts in that previous comic, and that other fact (from the title text) was referenced the week before this comic came out in 1732: Earth Temperature Timeline. But it could be a coincidence.

The Manhattan Project was the scene of 809: Los Alamos, and a story from the site is being told in 1520: Degree-Off. According to 980: Money the Manhattan

project used $24,400,000,000. Nuclear weapons in general has been a recurrent subject on xkcd and their invention was also mentioned last week in 1732: Earth Temperature Timeline around 1950 CE. The previous comic with a similar mushroom cloud was 1655: Doomsday Clock, and in that comics explanation at least three other "recent" comics about such weapons of mass destruction are mentioned.
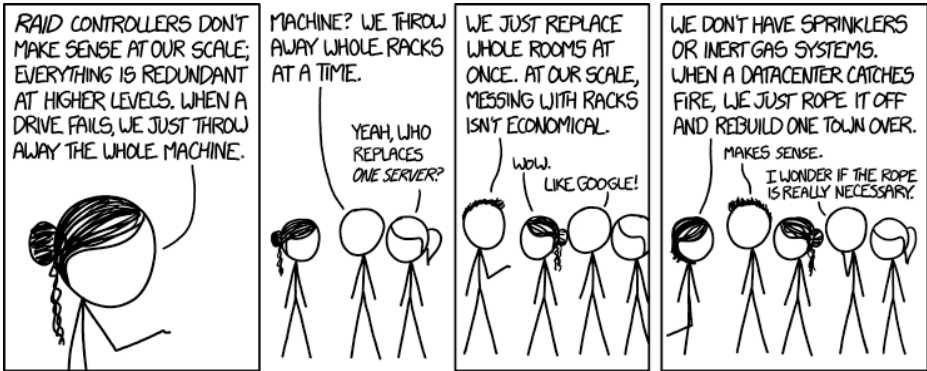
Asimov's Cosmic AC was created by linking all datacenters through hyperspace, which explains a lot. It didn't reverse entropy--it just discarded the universe when it reached end-of-life and ordered a new one.

Explanation

This comic expands, to the limit, the strategy that it's a net cost saving to allow cheap hardware to fail and simply replace it than to have robust but much more expensive systems to start with. The technique was made famous by Google circa 1999, when its successful cost-effective server designs were actually using sub-consumer, nearly junk, hardware.

RAID ("redundant array of independent disks") is a technology that splits data across several hard drives as if they were one. RAID comes in several levels (varieties) which have different applications, but one of the big applications of RAID is creating mirrored hard disks that back each other up. If one disk drive in such a RAID fails, no data is lost.

However, RAID is complicated to configure, so you don't want to be constantly setting it up. An alternative technique for data centers is, therefore, to simply send the data to several servers at once. This makes maintenance easier, but without RAID, one hard disk crash basically breaks the server. However, this is what Hairbun is doing since their scale is so large that fixing individual servers is actually more expensive than simply buying a new one for replacement, and instead of fixing the drive they throw away the machine. (More about this approach will be explained later on)

From here, the comic starts to exaggerate. Nowadays,

servers can be made extremely small ("Blade servers") and dozens of servers can be attached to one 19-inch rack in a data center. Rather than going to the effort of unplugging and unscrewing one blade from the rack, when a blade fails at Cueball's data center they just throw away the rack, and Ponytail agrees and mildly mocks Hairbun for replacing one server.

Hairy's data center goes one step further - they have so many servers that they would constantly have to be throwing away and replacing racks, so instead they just build a new room when one rack fails. This would be currently possible with small modular data centers that are built in shipping containers for easy transport and can be linked together to expand capacity. Here the cargo-container "room" with the failure would be quickly swapped with a fresh one. Cueball adds "like Google!" - Randall previously mentioned Google's approach to hard drive failures in the what if? article Google's Datacenters on Punch Cards. Back in 2007 they had one failure every few minutes, which might have increased hugely since then.

Finally Megan appears and her company, of course, breaks the scale of silliness in exaggeration. She says that they don't have any fire extinguishers (neither regular sprinklers nor the systems that deploy gasses like FM-200 which alter the room air's ability to sustain a fire). Rather, they just rope the center off, thus letting the data center burn down. Then they simply move a town over and build a new one. This may indicate they are so big that the entire town will burn down if their center

catches fire, or else they did not have to skip town. Alternatively, they just leave the center burning and this may cause problems in that town, so they simply flee the premises.

Most big internet companies do have multiple redundant data centers around the world, in order to increase speeds for users in different countries, but Megan's idea would be very expensive, result in increased latency, possibly kill people (either in their company, or other people in the town, since they do not try to put out the fire), and cause severe destruction of properties in addition to their own. These last two items would result in additional litigation and fines, and potentially jail sentences for the people charged with implementing the policy. They may also result in other towns being unwilling to take their business, out of fear they will wind up burning too.

Hairy still thinks that it makes sense, while Cueball wonders what difference the roping off does. This could again be a reference to the fact that they just let the buildings burn without bothering about the local consequences, and the next step is just one more step towards the extreme of the title text. Or, he's contemplating that they're just wasting more time by roping it off.

This comic references how, as data requirements expand, the cost of time eventually outweighs the cost of hardware at ever increasing scales (drive, rack, room, building). While this comic takes this to the extreme, with whole buildings being destroyed for simple flaws,

the concept is not as far-fetched as it seems if "thrown out" is taken to include being sold to equipment refurbishers. It could indeed be cost effective for a large data services provider to resell racks or even whole data center modules at some significant fraction of their "as new" price as opposed expending the time and effort to attempt a repair. The equipment refurbisher would then rely on a cost advantage like cheaper labor to repair the flaw and sell it back to Google or another company with less demanding requirements. Equipment rental firms already operate on this model and with the added incentive customers preferring to rent newer models, this means that the equipment is often preemptively replaced before failures even occur.

The title text refers to Isaac Asimov's science-fiction short story The Last Question (comic version), where humanity asks, at different stages of its spacial and technological development, the same question to increasingly advanced computers: "How can the net amount of entropy of the universe be massively decreased?". At each point, the computer's answer is that it does not yet have sufficient data for a meaningful answer. Ultimately, the computers are all linked through hyperspace, outside the physical boundaries of the universe, and make up a single computing entity named AC which keeps pondering the question even as the heat death of the universe occurs and time and space cease to exist. When AC finally discovers the answer, since there is nobody left to report it to, it decides to demonstrate it and says "LET THERE BE LIGHT!", which are the first

words said by God during the Creation, according to the Book of Genesis. Here, the title text implies that, as the universe died, AC no longer had a use for it as a physical support and, taking the comic's logic to the next extreme, chose to discard it and get a brand-new one instead of bothering to "fix" it by reversing its entropy. This short story was also referenced in 1448: Question.

This comic's concept of taking a real-world phenomenon and exaggerating it to levels currently considered implausible for comic effect closely mimics an earlier comic which describes progressively more "hardcore" programmers in 378: Real Programmers. This comic might be related to 1567: Kitchen Tips which suggests not throwing away your dishes but washing them, and 2033: Repair or Replace, which is also about discarding servers instead of fixing them.

#1738: Moon Shapes

September 26, 2016

INTERPRETING THE SHAPE OF THE MOON IN ART

SHAPE	NORMAL?	
○	✓	"FULL" OR "QUARTER" OR "HARVEST" OR "WAX GIBBON" OR WHATEVER
◐	✓	
☽	✓	
◗	✗	NOT POSSIBLE AT NIGHT
◖	✗	ONLY POSSIBLE DURING A LUNAR ECLIPSE (#1 ONLY, DUBIOUS) OR A SOLAR ECLIPSE (BRIGHT PART IS THE SUN)
☾	✗	
☾	✓	LOOKS OK
☾	✗	THERE'S EITHER A HOLE IN THE MOON OR A NUCLEAR WAR ON ITS SURFACE

Whenever I see a picture of the moon where the points go more than halfway around, I assume it's being eclipsed by one of those Independence Day ships and interpret the rest of the image in light of that.

Explanation

The Earth's Moon, being the most prominent object in the night sky (most of the time), is a frequent subject of art; particularly art depicting a nighttime scene. Unfortunately, the Moon often appears in works of art in ways that are very dramatic and would not be realistically possible. It may be done out of ignorance, or knowingly by taking artistic license. As someone interested in and who has worked in astronomy, this likely bothers Randall.

The Moon is well known to have "phases" describing what portion of the visible surface of the Moon is illuminated by sunlight and highly visible, and what portion is dark, and generally only slightly visible when the Moon appears while the Sun is also up. These phases progress between "New" (when the surface facing the Earth is completely dark) and "Full" (when the surface facing the Earth is completely illuminated, appearing as a full disk as viewed from Earth). Mid-way between those extreme phases is a "Quarter" Moon, when exactly one-half of the surface facing Earth is completely dark - at this point the Moon is a quarter of the way in its cycle from the New Moon, either one quarter of the way into it ("First" Quarter) or a quarter of the way from completing it ("Last" Quarter).

Because the Moon is approximately spherical, its illuminated side appears as "crescent" in shape as it progresses from New to First Quarter phase. As it

progresses from First Quarter to Full phase, observers on Earth see a Waxing "Gibbous Moon (which just means that the dark portion has formed a crescent). One can imagine this like a globe on which you draw a straight line from the north pole to the south pole down the center of the side facing you (appearing to create two semi-circles); upon rotating the globe, the line would become rounded as it moved away creating a crescent on the side the line was moved towards. Because of the geometry involved, a line connecting the two points (horns) of a Crescent Moon (or of the darkened crescent inverse of a Gibbous Moon) must be a diameter of the Moon (i.e. it must pass through the center of the circle).

The deliberate misidentification of a Waxing Gibbous Moon ("waxing" means going from new to full; that is increasing in illuminated area) as a "wax gibbon" (a Southeast Asian ape made of a nonpolar solid) is a source of humor in this comic. This is probably a reference to H.P. Lovecraft, who had several of his stories take place under "a gibbous moon" for dramatic effect, or even more likely a reference to the Discworld by Terry Pratchett, often referenced in xkcd (as in 1498: Terry Pratchett). In the witch series the Gibbous Moon is mentioned several times as the most magic, rather than the more often used Crescent or Full Moon.

Further, because the light portion of the Moon is illuminated by sunlight (whether or not the Moon is in the sky at the same time as the Sun), the light side of the Moon will always be facing towards the Sun. If the Moon is in the night sky, the Sun must be somewhere

"below" the horizon on the other side of the Earth. Thus, at night, the light portion of the Moon must always be on the half of the Moon that faces the horizon (there are points during the daytime when the orientation can go the other way); however, because of the moon tilt illusion it is possible for the light portion of the Moon to appear to point up. The moon tilt illusion is generally not as severe and may only last a few hours after sunset.

All this relies upon the 'direction' of the Moon's curve (the direction in which the lit part bulges) pointing towards the Sun, which the observer may or may not see but could also infer the direction of if they have a good idea of what the local time is (before or after midnight) and/or what general orbital track the Sun and Moon are taking across the sky (the ecliptic, a track which may appear curved against the night sky and horizon). By knowing either, clearly observing the Moon can be useful in determining the other and aid in night-time navigation/time-keeping, as the amount of crescentness also indicates how close below the horizon a recently set (or soon to rise) Sun will be, for any given position of the Moon itself. Not depicted here, but commonly seen in illustrations, is a crescent Moon 'facing' by its concave indent (often styled with sharply jutting chin and forehead) the Sun, when the rounded bulge of the lit hemisphere should be the one directed at its solar lightsource. When the Moon is too full to note even a gibbous assymetry, this is because the Sun is (more or less) exactly opposite the Moon, from the earthly observer's point of view. If the Moon has just risen, the

Sun will have (or, if the Moon is not quite full, perhaps very soon will) set at the other side of the horizon (its relative position depending upon latitude and season); if the Moon is full and close to setting, the Sun is similarly close to rising; if the Moon is at its highest point and seems to be at its fullest, the Sun is at its lowest (below and behind the observer, and it is close to astronomical midnight — thus, similarly, a Moon should also not be depicted as full, or significantly gibbous, when next to a storybook Sun.

It is worth noting that while the Moon's dark portion blends imperceptibly with the dark night sky, it is still a solid body. Therefore, it would be impossible to see more distant objects such as stars "through" the dark portion of the Moon's circumference. This is most dramatically exemplified by a solar eclipse during which the Moon passes in front of the Sun and is therefore completely dark (the Sun is lighting only the far side), but the Moon's circumference still blocks a circular portion of the Sun's light. Therefore, if we were to see any lights in the part of the sky the dark side of the Moon blocks, they would need to be from sources between us and the Moon's surface, such as a nuclear war on the Moon.

This comic lists some of some common mistakes. In some cases, a depiction may be unrealistic in multiple ways - for example, the Flag of Tunisia has both unrealistic horns and a star visible between the horns, while the Charles VI tarot shows a Moon with over-long horns pointing towards the horizon.

In the title text, Randall is referring to the movie Independence Day and how one of the alien's ships (in the movie) 'eclipses' part of the Moon. He says that if the points go halfway or longer around the Moon, then he imagines it's caused by an alien ship and interprets the entire piece of art in that context (i.e. aliens are about to attack those shepherds!).

#1739: Fixing Problems

September 28, 2016

WHAT ARE YOU WORKING ON?

TRYING TO FIX THE PROBLEMS I CREATED WHEN I TRIED TO FIX THE PROBLEMS I CREATED WHEN I TRIED TO FIX THE PROBLEMS I CREATED WHEN...

'What was the original problem you were trying to fix?'
'Well, I noticed one of the tools I was using had an inefficiency that was wasting my time.'

Explanation

Due to the complex relationships within a program or other system, making an alteration can cause problems with other parts of the program. This can lead to a seemingly small "fix" becoming a long chain of debugging and consecutive fixes, which Cueball is in the middle of, a typical example of recursion being a common theme within xkcd. As Cueball attempts to solve the initial computer issue, he creates more problems along the way.
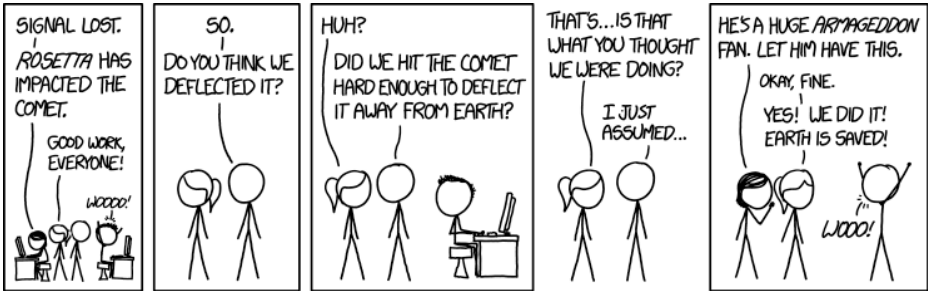
The title text suggests that the original problem was not stopping the function of the program and the benefits that Cueball may have hoped to achieve with the mentality of "If it ain't broke, break it and fix it" are being consumed by the expanding effort of the fix. Attempting to solve all of these problems results in more time wasted than he hoped would be gained by optimizing the inefficient tool described in the title text. Though depending on the tool, he could publish the changes once completed, allowing the community using that tool to gain back the man-hours collectively. Wondering if something is worth doing has been a subject in 1205: Is It Worth the Time?

This comic is similar in thesis to 1445: Efficiency and 1319: Automation. Other relevant comics include 1171: Perl Problems, where using regular expressions causes more problems than it solves, 349: Success, where Randall comments on the goals of a project decreasing in

optimism as a project goes on due to more and more problems distracting from the original, and 1579: Tech Loops, which shows that attempting to fix one problem in a piece of software can force a developer to delve into seemingly irrelevant parts of the relevant tech loop that the software in question is trapped in.

#1740: Rosetta

September 30, 2016

SIGNAL LOST.
ROSETTA HAS IMPACTED THE COMET.

GOOD WORK, EVERYONE!

WOOOO!

SO.
DO YOU THINK WE DEFLECTED IT?

HUH?
DID WE HIT THE COMET HARD ENOUGH TO DEFLECT IT AWAY FROM EARTH?

THAT'S...IS THAT WHAT YOU THOUGHT WE WERE DOING?

I JUST ASSUMED...

HE'S A HUGE *ARMAGEDDON* FAN. LET HIM HAVE THIS.

OKAY, FINE.

YES! WE DID IT! EARTH IS SAVED!

WOOO!

I WONDERED why he kept asking whether we thought the impact speed was too low.

Explanation

On the day this comic was posted (September 30th 2016), the Rosetta mission ended with the final descent of Rosetta onto the comet 67P. Landing Rosetta on the comet gave the scientists (Ponytail, Megan and Hairy) a chance to collect extra data from very close to the comet, using the spacecraft's powerful sensors.

Cueball however assumed that the landing was a "kinetic impact" mission to deflect a comet that was on a collision course with Earth. A similar scenario (but using a nuclear weapon implanted inside of the asteroid to deflect it) was depicted in the 1998 film Armageddon, of which Cueball is apparently a fan. Armageddon is a high-throttle action movie, infamous among NASA employees for its incredibly liberal application of artistic license. IMDb has a list of factual inaccuracies.

In reality, at the time Rosetta landed, 67P was already leaving the inner solar system and was a long way past Earth. It will return to the inner solar system in around 5 years' time, but its orbit will not pass close to the Earth in any foreseeable time.

Also, as the title text hints, Rosetta's speed was only 90 cm per second relative to the surface at the moment of impact (or about 2 mph/3.25 km/h; the speed of a slow walk), while the comet was traveling at 14.39 km/s. Given that Rosetta only weighs a couple of tons (or six horses), and 67P weighs nearly 10 billion tons (or 22

billion horses), Rosetta's landing will have no actual measurable effect on the comet's momentum. Cueball however, thinking they were trying to deflect the comet, would have thought the impact speed would need to be higher.

Rosetta (and its lander, Philae) were previously the subject of the comics 1402: Harpoons and 1446: Landing, and were mentioned in 1461: Payloads, 1547: Solar System Questions and possibly 1621: Fixion.

#1741: Work

October 03, 2016
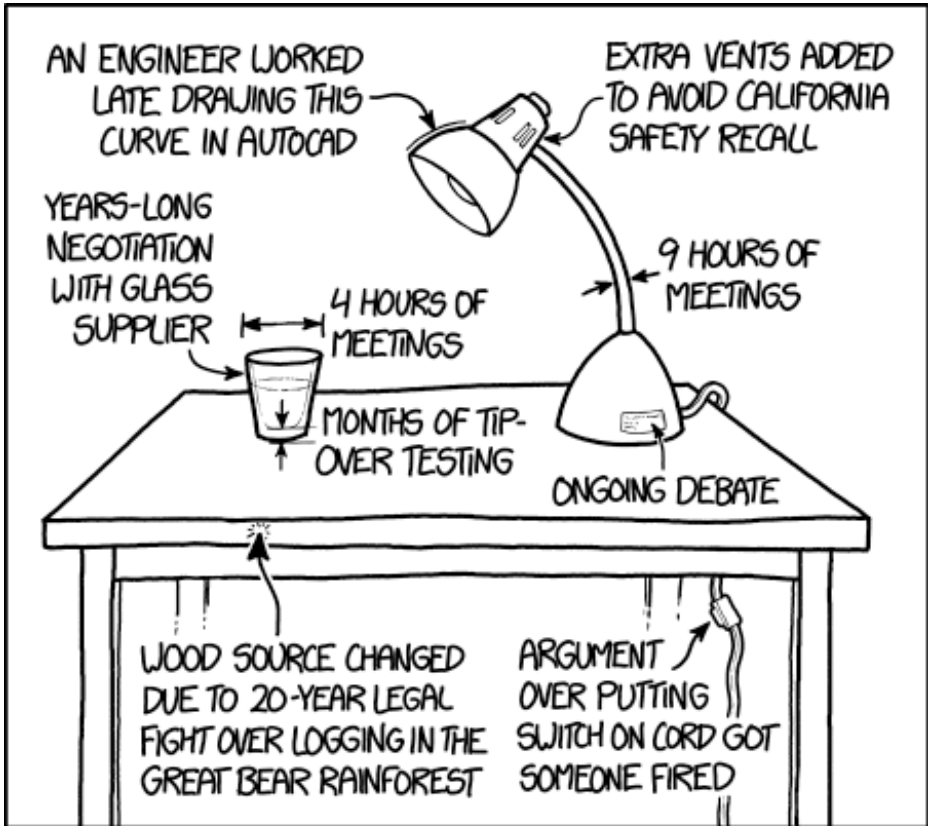
SOMETIMES I GET OVERWHELMED THINKING ABOUT THE AMOUNT OF WORK THAT WENT INTO THE ORDINARY OBJECTS AROUND ME.

Despite it being imaginary, I already have **SUCH** a strong opinion on the cord-switch firing incident.

Explanation

This comic details a set of theoretical examples of how much work went into the design and manufacture of everyday objects. See explanation of individual design elements below.

The joke centers around the fact that most people in modern times are constantly surrounded with human-built objects, which we generally use without giving them much thought. Randall implies that he occasionally imagines what went into seemingly simple objects around him (in this case his desk and the water glass and the desk lamp on top of it), and finds it overwhelming. This is because there are so many built items around us, many of which are inexpensive and mass-produced, which nonetheless resulted from a great deal of human effort.

This is similar to the thesis of the classic essay I, Pencil, except that while I, Pencil idealizes manufacture and commerce to argue for the free market and against regulation, the comic focuses on details that are far more human or based in bureaucratic or government red tape.

Presumably, this kind of realization is more likely for people who've worked in design and engineering, like Randall, because they have some insight into what's involved in bringing a product to market. Also people who sit around all day wondering what could be funny, like Randall, could also end up in such a thought spiral.

The comment about California recalls is based on the tags on products that often state "This item has been known by the state of California to cause..."

There's a double joke in the title as the first thing most people will think of, when seeing such a table with a typical desk lamp, is that this is a work desk rather than about all the work put into making the desk and lamp. The potential implication is that Randall is so distracted imagining the work that went into creating his workspace that he can't get his own work done, hence the title. (Interestingly, but without being related to this comic, the next comic was called 1742: Will It Work).

The argument over putting the switch on the cord getting someone fired hits on another aspect of the design issue. Companies that design and manufacture goods will inevitably have human conflicts, where decisions will be argued over, and human personalities and office politics will impact the final design.

In the title text Randall states that this incidence is imaginary (based on his imagination) but still he has apparently come up with an entire fictional narrative about the conflict over whether to put the lamp's switch on the lamp body itself, or to attach it to the lamp's power cord. And now he has SUCH a strong opinion about the firing incident.

This may be because he already had a strong opinion about who was right, which could make him angry if that person was the one getting fired. Randall's distaste for

lamps where the switch is on the cord was mentioned in the title text of 1036: Reviews. As the lamp on this desk is with the switch on the cord, and as it seems Randall really dislikes such lamps, this would make sense, as it would probably be the one wishing to put the switch on the body who were fired. Alternatively it could have been the one who put the switch on the wire that was fired later, when they got poor on-line reviews...

Using the lamp as shown on this desk would make it annoying with the switch on the cord, as it will be hard to reach under the table, when sitting at the desk. Often such lamps have the switch either at the main body or on the head of the lamp. That would make it easy to reach it while sitting at the desk.

A similar theme of the unseen contributions of engineers is found in 277: Long Light, including the title text: "You can look at practically any part of anything manmade around you and think 'some engineer was frustrated while designing this.' It's a little human connection." This fits in well with Randall's annoyance with a switch on the cord, as he might believe it was a frustrated engineer that is the cause of such an inconvenient placement of the switch.

Individual design elements[edit]

#1742: Will It Work

October 05, 2016

LIKELIHOOD YOU WILL GET CODE WORKING
BASED ON HOW YOU'RE SUPPOSED TO INSTALL IT:

VERY LIKELY

APP STORE
OR PACKAGE
MANAGER

GITHUB LINK

SOURCEFORGE LINK

GEOCITIES/TRIPOD LINK

COPY-AND-PASTE
EXAMPLE CODE FROM
PAPER'S APPENDIX

ANYTHING THAT "REQUIRES
ONLY MINIMAL CONFIGURATION
AND TWEAKING"

UNLIKELY

'Copy and paste from a random thread on a website' is the hardest to predict, and depends on the specific website, programming language, tone of the description, and current phase of the moon.

Explanation

This comic humorously lists how likely computer code is to function on the user's computer based on the source of the code.

App store or package manager: Most likely referring to the Apple's Mac or iOS App Store, Google's Google Play, Microsoft's Windows or Windows Phone Store, or package managers such as Debian's Advanced Packaging Tool (APT). Programs in the App Store are already compiled from raw code into executable files that have been tested on their respective platform -- otherwise they would be rejected from the storefront -- and so should be expected to run with no effort from the user. Similarly, a package manager for a Linux OS handles downloading and installing the program requested, as well as installing any dependencies (other programs or libraries needed by the desired program, potentially including locusts) automatically.

GitHub Link: GitHub is a website where people can host Git repositories of code that they are working on. Since Git is built to track changes in code for an entire project, it is likely that all of the code needed to run the project is included in the download. One reason it may be less reliable than the previous entry is that it may not include external libraries expected to already be on the user's computer.

SourceForge Link: SourceForge is similar in scope to

GitHub : hosting source code repositories but also binary packages. But it is older and dwindling in popularity. As a result, a project hosted on SourceForge is more likely to be abandoned.

Geocities/Tripod Link: Geocities is a now-defunct free website host. Tripod is a similar website host owned by Lycos. The fact that the software comes from there means that nobody has paid attention to the project since Geocities shut down, which could mean that code rot has begun to take effect, with various dependencies being less and less likely to work over time.

Copy-and-paste example from paper's appendix: Some academic papers publish code or pseudocode (example of a paper with pseudocode in appendix) in order to illustrate their concepts, strategies or algorithms. Often this code is not meant to be compiled because it is thought to illustrate ideas rather than be used in an actual working piece of software. Copying and pasting this code and trying to compile it will rarely give satisfactory results, and that is why it is at this point in the comic's spectrum.

Anything that "requires only minimal configuration and tweaking": The punchline of the comic is that something advertised as having been tested and working with "minimal configuration and tweaking" on the system it was developed on turns out to be a frustrating mess that will almost inevitably require huge fixes for anybody else trying to get it to function. It's also often used by technically advanced people who are not aware of how

difficult even minimal configuration and tweaking can be for beginners.

The title text refers to websites such as Stack Overflow that allow users to post questions about their code and have other users provide answers. Websites like Stack Overflow usually generate useful answers but the quality may be lower if the conversation is disgruntled (i.e. if the asker has put in very little effort to solve the problem themselves) or if the language is less commonly used. The title text of 1185: Ineffective Sorts also references executing arbitrary code until it works, in that comic the code is actually mentioned as being from StackOverflow.

Saying that something "depends on the phase of the moon" usually means that there is some apparently random component to the problem, as neither the performance of a program nor the quality of answers on websites should depend on the position of the moon in its orbit. However, there was at least one case where the phase of the moon did, in fact, trigger a bug in code. This comic was released the day after Rosh Hashanah, a Jewish holiday that always occurs at or near a new moon. It is not clear whether this is why Randall was thinking about moon phases or just a coincidence.

The shape of the moon was the subject of 1738: Moon Shapes released during the week before this comic was released. This comic is called Will It Work, the previous comic was just called 1741: Work

#1743: Coffee

October 07, 2016
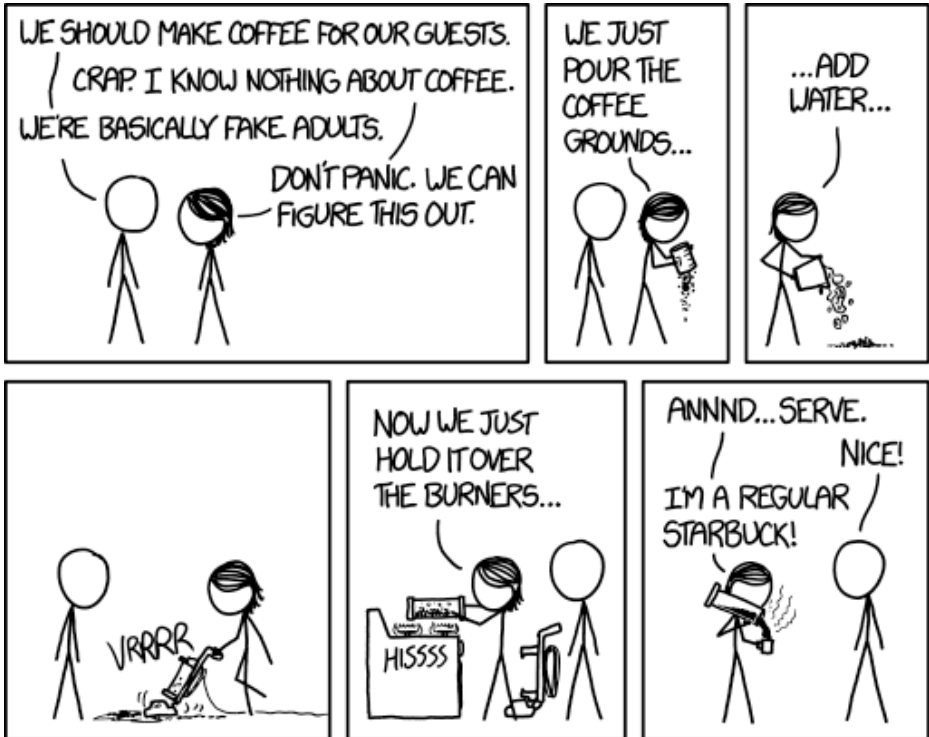
Remind me to order another pack of coffee filters from Dyson. Man, these things are EXPENSIVE.

Explanation

In this comic Cueball and Megan are anticipating guests. Offering coffee to house guests is a commonly-accepted courtesy in the United States (and most of the western world [and rest of the world {except where people serve tea}]). However, they seem to be unaware of the basics of coffee making. Cueball is concerned that this lack of knowledge is an indication of their mutual immaturity (thinking of himself as a "fake adult").

This comic thus follows a frequently used theme of people growing up but finding themselves unable or unwilling to accept traditional adult roles (see 150: Grownups, 441: Babies, 616: Lease, 905: Homeownership and 1674: Adult). While there are cultures where coffee is served to children, it is generally seen in the United States (and western world [and rest of the world {especially where people serve tea}]) as an adult beverage—like beer which has also served as the subject in the comic 1534: Beer.

Megan is, however, confident that the necessary steps can be determined. The steps she follows however are quite unorthodox...

She attempts to make coffee by pouring the ingredients on the ground (misinterpreting the meaning of "ground coffee"), sucking it up with a Dyson vacuum cleaner (misinterpreting the meaning of "vacuum brewing"), then boiling the mixture by placing the vacuum cleaner's

removable plastic canister over a hot stove, and pouring the resulting sludge through the vacuum-cleaner filter (instead of a standard coffee filter).

Megan says she is a regular "Starbuck" after pouring the batch of coffee, believing the name of the cafe chain Starbucks to be synonymous with the actual job title "barista", further indicating a general lack of knowledge regarding the subject of coffee. The Starbucks coffee chain was loosely named after the fictional character Starbuck from the book Moby Dick, so she could be referring to this, although Starbuck had nothing to do with coffee brewing! The third possible interpretation is that Megan is unaware of the reason for Starbucks' naming and thought that it was the possessive "Starbuck's" and that the founder was named Starbuck. See more trivia about Starbuck below. A fourth interpretation could be that Megan is a regular Starbucks customer and has watched the baristas prepare her coffee, which makes sense considering the fact that she probably has not made coffee much. If this is the case, it could be a direct jab at Starbucks, suggesting their coffee has a quality similar to that of coffee made on the floor.

This method of making coffee would be very expensive as it would most likely destroy the vacuum-cleaner canister and filter. If the vacuum cleaner had ever been used, then it would not be very hygienic either, although if it had not been used then the floor would probably also be very unhygienic anyway. Since the plastic from the canister has probably also gone into contact with the sludge after being heated over open fire, there is a high

risk that this "coffee" is actually poisonous for more than one reason.
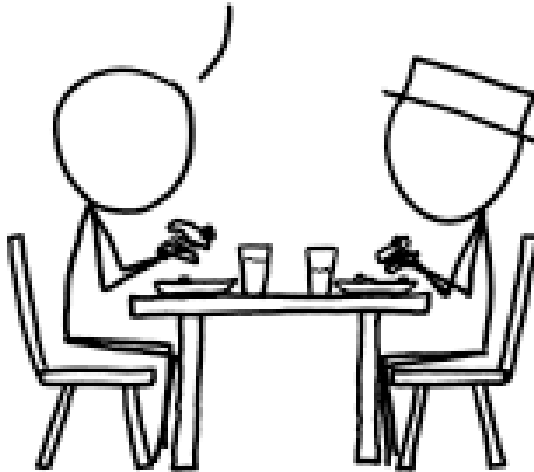
The title text refers to the expense of replacing the "filter", as vacuum-cleaner filters are considerably more costly than single-use coffee filters.

This was the first of two comics in a row about food, the next being 1744: Metabolism.

I have this weird thing where if I don't drink enough water, I start feeling bad and then die of dehydration.

Explanation

Eating is fundamentally a process where energy from food gets absorbed into the body in order to drive every cellular process in the body. Energy that is absorbed but not needed in the short term gets converted and stored as body fat. This is called metabolism. Consuming too much food and not exercising enough are major factors for obesity, which is a problem in many first world countries today, especially in the United States.

For obese people, losing weight is often an enormously difficult task. Standing in stark contrast, there are also lean people who do not seem to ever gain any weight even though they appear to eat whatever and however much they want. This leads some people (including the lean people themselves) to believe that one can have a special metabolism where excess food energy somehow does not affect the body. This belief is common, though not supported by scientific evidence.[actual citation needed] The comic makes fun of that kind of notion. While Cueball describes to White Hat how his metabolism is "special" (the phrase "one of those" implicitly meaning unusual), he is in fact only describing the normal case: no matter what he eats, his body converts the food to energy and stores any excess food as fat which stays in his body for future use.

The title text stretches this further, telling about the normal habit of drinking water (and the consequences of not drinking it) as something odd. Starting to feel bad at

first and eventually dying if refraining from drinking for too long a time are perfectly normal consequences of dehydration. This was also touched upon in 1708: Dehydration, in which Megan spent all day researching whether low-grade dehydration is really a thing -- ironically forgetting to eat or drink at all, to predictable results.

Obesity has only fairly recently become a public health issue due to lifestyle changes brought on by technologies such as industrialization and trade. Human bodies evolved under conditions where it was hard to ever find enough to eat, so to store as much excess energy as possible as fat was a beneficial adaptation. Historically, stored fat would be consumed during hard times that was sure to come. The act of collecting food through farming or hunting/gathering also demanded physical labor which limited the amount of excess energy that would remain. In comparison, people nowadays hardly need to expend any energy to buy their food from a nearby market. They also have much more sedentary lifestyles and rarely ever go hungry. Without an active commitment to exercise more or eat less, there would almost never be a shortage of energy and no chance for body fat to be used. Randall has previously shown how bad his health becomes when he starts eating lots of fat (or sweet) food in 418: Stove Ownership.

There are many rational explanations for why some people might not gain weight despite eating a lot. For example, it's possible that they only eat a lot during special occasions and social gatherings, where they are

easily seen eating. On more private occasions when no one is watching, they could just as well eat much less or even skip entire meals. They might also lead a much more active lifestyle and thus require more energy than an average person despite their thin appearance. Other less pleasant reasons might include chronic diseases, parasite infections, or eating disorders.

This is the second comic in a row about food, the previous being 1743: Coffee.

#1745: Record Scratch

October 12, 2016

The **78**-rpm era was closer to the Civil War than to today.

Explanation

A vinyl disc (also known as a gramophone record) is a type of storage medium that stores audio recordings on the disc by carving the audio data into a continuous spiral groove on the surface of the disc. These are typically played on a phonograph (also known as record players (since 1940s) or, most recently, turntables). The player spins the disc as a stationary stylus rides along the groove. The movement of the stylus along the groove is converted by an electromagnetic or piezoelectric transducer into a corresponding electric current, which an amplifier then converts to sound.

The noise referred to as a "record scratch" can be caused by someone attempting to stop a record's play by dragging the stylus across the radius of the record, or by stopping the disc's rotation with one's hand (opposing the turntable's rotation). As a result, this is often used as a sound effect in movies for comedic effect. This type of sound is also often used in hip-hop music; in particular, rapidly and manually rotating the disc in both clockwise and counterclockwise directions.

The comic pokes fun at a movie cliché in which the story opens with the main character in some kind of unbelievable predicament, followed by a record scratch, seemingly freezing time (using the sound of a sudden pausing of a record to symbolize the sudden pausing of time in the movie). As the action in the film is paused, a character narrates something along the lines of, "Yup,

that's me. You're probably wondering (how I ended up in this situation)..." The rest of the story then follows, often with the film going back in time to depict the events that leads up to the situation of the opening scene.
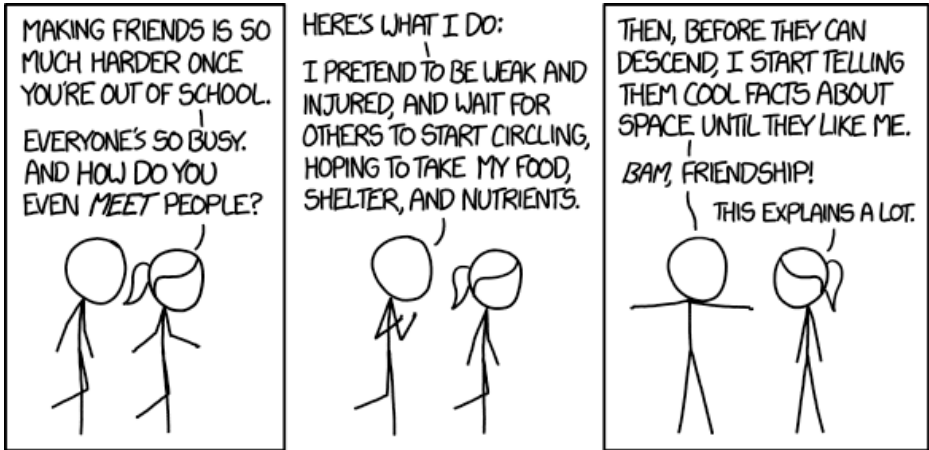
In this case, it would be interesting to know why Cueball is at a party where everyone has wine glasses in their hands, but suddenly one of the glasses (Cueball's or his nearest adversary's) is lying on the floor, and it seems like a fight is about to break out. This is what an opening narration might begin to explain (typically in a flashback) after the record scratch. At the time of the comic's posting, parodying the cliché, variations on the phrase had become a popular meme on social media. As the record scratch continues to be used despite the fact that record players (gramophones) have largely become obsolete technology, Randall pokes fun at this by beginning this meme by giving the backstory on what that sound actually is, (as many people from the younger generation may very well not know this), rather than giving context to the situation via a story. This is yet one more of Randall's comics that is trying to make people feel old, and is likely most relevant to those who have actually used vinyl to listen to music, comedy or other recordings.

The title text indicates (in a manner similar to that of 891: Movie Ages) that the "78-rpm era" – referring to the fact that the original industry standard of records making 78 revolutions per minute (rpm) (1925-1950s) – is now closer to the time of the American Civil War (1861-1865) than it is to present day, another way that

Randall is making the reader feel old. Note; these 78 rpm records were made of shellac, not of vinyl.

#1746: Making Friends

October 14, 2016

Panel 1:
MAKING FRIENDS IS SO MUCH HARDER ONCE YOU'RE OUT OF SCHOOL.

EVERYONE'S SO BUSY. AND HOW DO YOU EVEN *MEET* PEOPLE?

Panel 2:
HERE'S WHAT I DO:

I PRETEND TO BE WEAK AND INJURED, AND WAIT FOR OTHERS TO START CIRCLING, HOPING TO TAKE MY FOOD, SHELTER, AND NUTRIENTS.

Panel 3:
THEN, BEFORE THEY CAN DESCEND, I START TELLING THEM COOL FACTS ABOUT SPACE, UNTIL THEY LIKE ME.

BAM, FRIENDSHIP!

THIS EXPLAINS A LOT.

"This seems more like a way to attract turkey vultures."
"My mom always told me a turkey vulture is just a friend you haven't met yet, usually because you don't smell enough like decaying meat."

Explanation

Ponytail is complaining to Cueball that it is hard to make new friends once you are out of school. She even has problems just meeting new people, let alone making those new people her friends.

This is a common problem, or maybe rather an advantage of going to school. In school you are forced together with a group of people you have to see every day and work together with in groups. This is a great catalyst for making new friends. In the early grades the kids haven't had time to form many friendships so they are ready to make new friends, and later in college the young people often move away from their home town, and thus have no friends in their new town, and are again ready to make friends. Later in life it is rare to be put in a similar situation, and the people you do meet might already have several friends; for most people there is usually a rather low limit on how many friends it is possible to keep close. Thus many feel it is hard to make new friends compared to when they went to school.

Cueball has a solution, but it is very weird. He says he pretends to be injured, and then, as if he were a weak animal on the savanna, he expects other people to begin circling around him, not directly to eat him, but to take his food, shelter and nutrients. This is a weird formulation as nutrients is what you get from your food, so either he is referring twice to his food, or he actually refers to his value as nutrient (i.e. food) for another

being. Also it is unlikely for a person to steal his shelter, unless this refers to his clothing, as "the shelter" would usually be seen as a normal person's house, which is rather hard to take,[citation needed] especially if the person is renting and it belongs to someone else.

He then talks about these possible future friends as if they will descend on him, making it sound even more like they are birds hanging above him like vultures. But his plan is to start telling these people who are ready to rob him of his life support cool facts about space before they get a chance to descend, and then make them like him based on this knowledge. And then before they know what hit them, they are instantly his friends. If this were actually about vultures, his method could be used to trap said vultures, a trick that might be used to try and capture vultures by tricking them to come down in order to eat them yourself (if stuck in a desert, etc).

Cueball seems to think this is a fantastic idea, as shown by his arm gestures. But Ponytail seems to think otherwise. Her comment this explains a lot is probably a reference to other strange habits of Cueball that she has observed. Or his lack of other friends. Or there was a story about how they met that had confused her until this conversation occurred...

The logic of Cueball's "friends" could be that Cueball is extremely rich. If he pretends to be near death, some cynics might try to become closer to Cueball to gain at least some of Cueball's wealth upon his death.

In the title text Ponytail mentions that what Cueball has just described fits well with the behavior of turkey vultures rather than humans. Turkey vultures are a type of bird of prey which feeds on carrion. They are known to identify and circle weak, injured, dead or dying animals so they can eat them (take their nutrients).

As they are animals they would not care about cool facts about space, but Cueball did seem to talk about other humans in the main comic. The title text, however, goes even further out this line and have Cueball cite his mom: "My mom always told me a turkey vulture is just a friend you haven't met yet, usually because you don't smell enough like decaying meat." This is a reference to the old saying: "A stranger is just a friend you haven't met yet", and the action of the vultures eating dead animals.

Smelling of decaying meat would be likely to attract the vultures but it should be noted that this is likely to drive away most other potential (human) friends, as most people don't like the smell of decaying meat. [citation needed] Also, there is very little reason to believe that you could become friends with vultures , although if you get up and show that you are not really injured, they are likely to give up and fly away rather than attack you, unless they are starving.

Vultures hanging in the air over prey that is about to die, was also the subject of 926: Time Vulture. Saying cool things about space, hoping that people like you, was the subject of 1644: Stargazing. The comic 1485: Friendship, was not about friendship...

#1747: Spider Paleontology

October 17, 2016
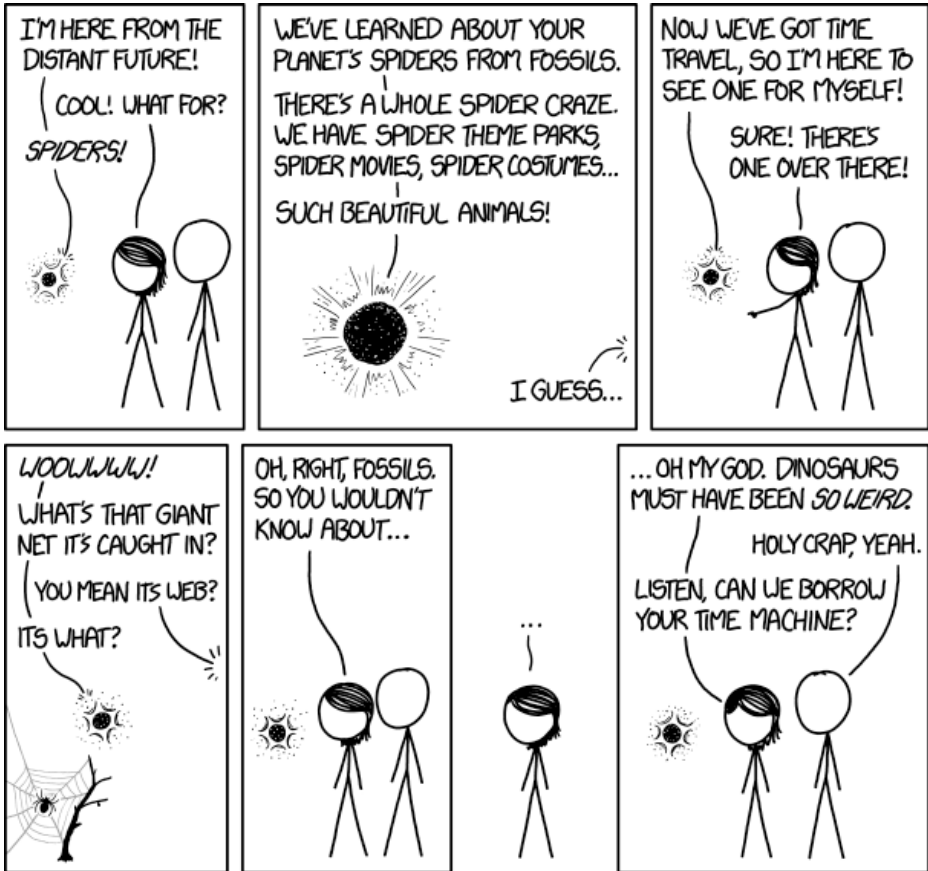
Whenever you see a video of birds doing something weird, remember: Birds are a small subset of dinosaurs, so the weirdness of birds is a small subset of the weirdness of dinosaurs.

Explanation

This Monday comic was the first in a series of two comics that continued in the next release 1748: Future Archaeology on Wednesday. Both comic in this series have titles of a noun followed by a field of research.

A time-traveler (the black floating energy Sphere) visits the present day from the far future. Spiders are the Sphere civilization's current craze, just as dinosaurs are currently our craze. The Jurassic Park media franchise began with the first film in 1993 and the year before the release of this comic in 2016, the fourth movie Jurassic World were released with at least one more film in development. We also have theme parks and kids dressing up as dinosaurs.

The time-traveler arrives in the presence of Megan and Cueball, and tells them who it is and why it is here, to see spiders which they learned about through fossils (See the explanation of the next comic about the strange fact that it speaks English). Megan points it towards a spider sitting in its web; the Sphere is awestruck to see the object of its obsession in the living flesh, but seeing it sitting in it's web, the Sphere asks why it has been caught. Megan realizes that because it only knows about spiders from fossils, it could come as a big surprise that the spiders sit in their webs like this. Spider silk does in fact fossilize in amber (and most fossils of spiders are also found in amber because the soft body of a spider does not easily petrify). The reason we know that silk threads in amber

are the spider's web is because we can compare fossils with the spiders of today. If not for the fact that we knew about spiders' webs in advance, it would be hard to say if we would have made the connection from the amber fossils. The Sphere is thus surprised to see the spider in a web since they had not understood any possible hint of spider webs in the fossil records, from which the Sphere's civilization gathered all their knowledge of spiders. Spiders have been on Earth at least for 380 million years and are still thriving and more than 40,000 species are known.

With our current knowledge, we know that webs are an essential part of a spider's life. Making sense of a spider's life is practically impossible without including their webs. However, the future-people have done just that until now; discovering how wrong they are is bound to become an intense experience for them. It should be noted that there have been multiple present-day discoveries of fossilized spiders' webs preserved in amber - however, since fossils forming like this is a rare event, it is quite possible that none would have been found (or rediscovered our own current stock) by the future-people.

Megan immediately connects the fact that the Sphere did not know about spider webs to our current understanding of dinosaurs: If a future civilization thinks they understand spiders based on fossils, while missing something as essential as their web, what is the human civilization missing about dinosaurs? Cueball quickly catches on, and Megan asks if they can borrow the

time-machine to experience their own revelations about dinosaurs just like the revelation the Sphere has just had about spiders.

The title text calls back to one of Randall's favorite facts (see 1211: Birds and Dinosaurs) - that birds are technically part of the clade Dinosauria. Birds do lots of weird stuff - like starlings flocking, the dances of birds of paradise, lyrebird mimicry or petrels puking stomach oil. Randall says that for every time a bird does something weird then it is likely that dinosaurs would have had equally strange behaviors, and birds are only a small subset of all dinosaurs. So there would have been even more strange behaviors among the dinosaurs than among the present days birds. It is, however, basically impossible to tell from the fossil record. All we know is that dinosaurs had features such as display feathers (like on a Peafowl (a descendant of dinosaurs)), neck frills, and crests (like on the Dimetrodon, which lived before the dinosaur with which it is not related) which likely played a role in mating and territorial shows.

It is unclear what the Sphere is. Since it states that what they know about spiders comes from fossils on our planet, it seems likely that the Sphere is neither human nor from our planet. So most likely they are a space traveling species and not human. The appearance as a sphere may either be an indication that they did not travel in person but rather only look out at the past through the energy sphere, or it may be that these aliens are actually spheres, floating as energized objects in space. In that case this is an actual alien floating in front of
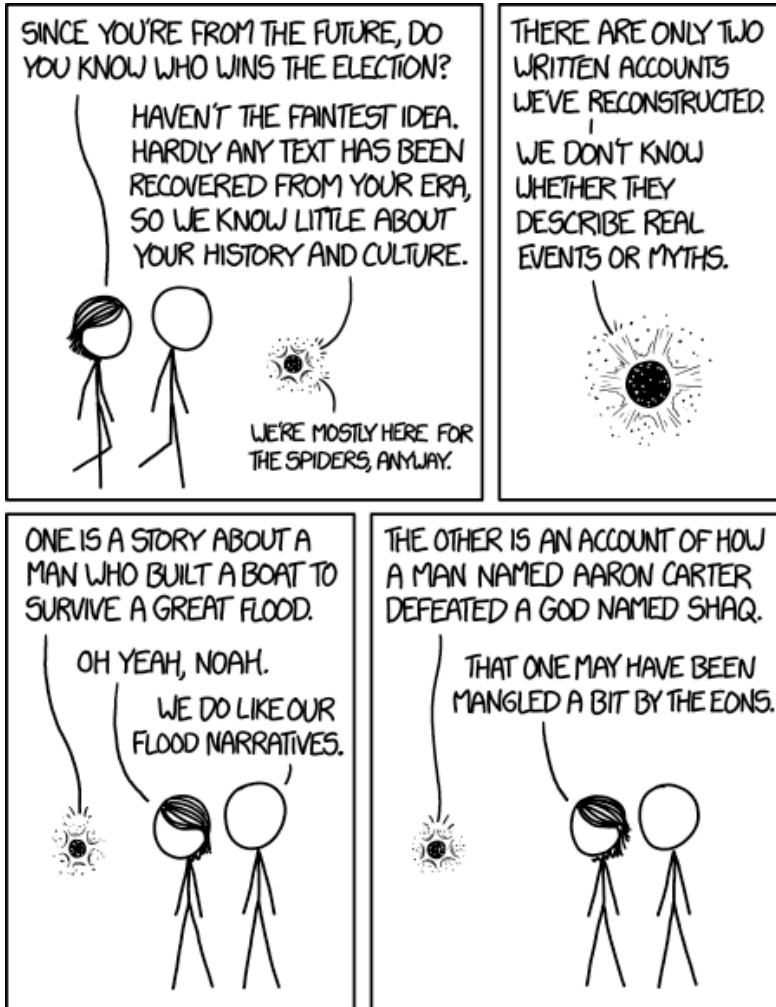
Megan and Cueball. It seems like the Sphere's civilization already had the spider craze before they invented time travel, and they decided to use time travel the first time to go back to see real spiders on Earth. This also tells us that they are from so far into the future that there are no spiders left. Of course with climate changes etc. going on, that may not necessarily be too far into the future. As long as the human race (or knowledge of spiders) has also disappeared from Earth. But since the Sphere itself tells us that it comes from a distant future, the setting is not related to how fast humans and spiders becomes extinct. As is seen in the next follow up comic, there is very little left of our current civilization, and no records of spiders and their webs.

This is the second comic with special mentioning of a science related directly to spiders, the first being 1135: Arachnoneurology.

In this comic Randall manages to combine no less than three of his favorite recurring subjects with time travel, spiders and, of course, dinosaurs.

#1748: Future Archaeology
October 19, 2016

SINCE YOU'RE FROM THE FUTURE, DO YOU KNOW WHO WINS THE ELECTION?

HAVEN'T THE FAINTEST IDEA. HARDLY ANY TEXT HAS BEEN RECOVERED FROM YOUR ERA, SO WE KNOW LITTLE ABOUT YOUR HISTORY AND CULTURE.

WE'RE MOSTLY HERE FOR THE SPIDERS, ANYWAY.

THERE ARE ONLY TWO WRITTEN ACCOUNTS WE'VE RECONSTRUCTED.

WE DON'T KNOW WHETHER THEY DESCRIBE REAL EVENTS OR MYTHS.

ONE IS A STORY ABOUT A MAN WHO BUILT A BOAT TO SURVIVE A GREAT FLOOD.

OH YEAH, NOAH.

WE DO LIKE OUR FLOOD NARRATIVES.

THE OTHER IS AN ACCOUNT OF HOW A MAN NAMED AARON CARTER DEFEATED A GOD NAMED SHAQ.

THAT ONE MAY HAVE BEEN MANGLED A BIT BY THE EONS.

"The only link we've found between the two documents is that a fragment of the Noah one mentions Aaron's brother Moses parting an ocean. Is that right?" "... yes. Yes, exactly."

Explanation

This Wednesday comic is a direct continuation of the previous comic 1747: Spider Paleontology from Monday about a time-traveler (the black floating energy Sphere) who has come back from far in to the future to see spiders (only known from fossils in their time). See 1747: Spider Paleontology for a more complete explanation of this part of the joke. This series ended with this comic. Both comics in this series have titles of a noun followed by a field of research.

Since Megan and Cueball now have access to the Sphere from the future, they ask if it knows who will win the election. This is a reference to the 2016 United States presidential election, which pitted the very controversial Donald Trump against former United States First Lady, Senator, and Secretary of State Hillary Clinton, who was also involved in several controversies. This comic was released about three weeks before election day. (The election was the subject of the comic released the day before the election 1756: I'm With Her, in which Randall endorsed Clinton directly.)

Sadly for Megan and Cueball, the sphere has come back from so far into the future that even spiders have gone extinct. (Whether humans also have is unclear, see discussion about this in 1747: Spider Paleontology). The Sphere makes this clear by stating that its civilization hardly knows anything about our era, and they know little about our history and culture. (And by the way it

only came back for the spiders, anyway). The idea is that history is filtered in similar fashion to fossils. What is contemporaneously important, like a spider's web, dinosaur feathers (see previous comic), or the United States presidential election may not survive. The Sphere tells them that only two written accounts have been reconstructed (note that they are not found in their entirety). And they do not know whether they even represent real events or myths. One of the two is indeed a myth, as it is about a man building a boat to survive a great flood. Megan recognizes this as being about Noah and his famous Ark from the Genesis flood narrative, as Cueball refers to. The other is a reference to a popular pop song.

The joke is that, in the future, the 2000 Aaron Carter hip hop song "That's How I Beat Shaq" (lyrics and video) is considered as valuable a historical document when researching humans as parts of the Bible. While secular historians consider the story of the Flood to be mythical, they still use it to infer facts about the early history of the Middle East, simply because there are a fairly small number of texts surviving from that era. "That's How I Beat Shaq" is, likewise, a fictional story including some true elements; it's just that as long as there are abundant sources documenting life in the year 2000, there's no reason to consult the song in any historical context. Yet it is the latter story that the time traveler assumes to be a clearly religious one, while seeing the former as a relatively straightforward survival story. A further layer of humor is that "That's How I Beat Shaq" is an

archetypal David and Goliath story—the story of David and Goliath of course being a Biblical one as well.

In fact, the Spheres civilization believes Shaq (Shaquille O'Neal, a 2.16 m (7 ft 1 in) tall professional basketball player) to be a god, who was then defeated by Aaron, a 14-year-old (and rather small kid) at the time of the release of his single in 2001. He beats Shaq on the basketball court one on one. Megan comments that the pop song may have been mangled by the eons.

The title text expands on the joke by letting the Sphere explain that the only connection they have found between their two historical documents is via the biblical story of Moses. As Moses is one of God's chosen prophets and leaders, like Noah and Abraham before him, these two stories appear close together in the Bible, though not close together chronologically, and it would be likely that their document with the Flood story also has some parts about Moses. Moses had an older biological brother named Aaron and the Sphere's civilization has hastily concluded that Moses' brother and Aaron Carter are the same. According to the Bible, God parted the Sea of Reeds (commonly mistranslated as Red Sea) for Moses and the Israelites. This is often referred to, either erroneously or out of simplification, as Moses having parted the Red Sea. Along with Noah's Flood, this is one of the two major times in the Bible that God effects grand change on a body or bodies of water.

This comic was published the day after the what if? article Flood Death Valley, thus referring indirectly to a

new possible flood history. It was the first what if? post in almost three months, the longest break between two post during 2016 (and third longest of all time at the time of its release), and it thus seems reasonable that there should be some kind of connection between that and this comic. A later comic (1750: Life Goals) also referenced this what if? post more or less directly. In this comic, Randall managed to combine no less than four of his favorite recurring subjects with time travel, spiders, politics and religion.

#1749: Mushrooms

October 21, 2016
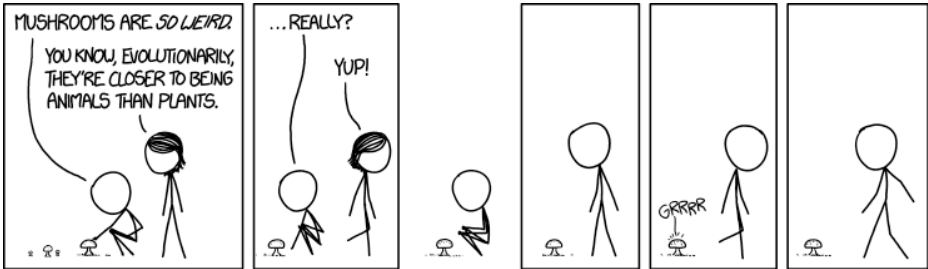
Evolutionarily speaking, mushrooms are technically a type of ghost.

Explanation

Cueball is looking at a mushroom, contemplating how weird they are, when Megan adds another layer to their weirdness by supplying the trivia that evolutionarily, mushrooms (which are basidiomycete fungi) are closer to the animal kingdom than to plants on the tree of life.

Both animals and fungi are part of the opisthokont group of eukaryotic organisms, while plants are in the archaeplastida group of eukaryotic organisms with the green and red algae. This surprises Cueball, as he, like many people, is likely to think of mushrooms as plants, as they are "grown" just like other crops. Even scientists, before the 1960s, considered fungi to be 'plants'; it took DNA-based studies in the 1990s and 2000s to 'seal the deal' and place the fungi with the animals, and not the plants. Fungi do not perform photosynthesis, and therefore do not need sunlight to grow. Instead, they get their energy from other living matter, either live (parasitic mushrooms) or dead (e.g. manure; saprobic mushrooms). Edible mushrooms like Agaricus bisporus (or white mushroom) are saprobes, farmed in caves. The body plans of fungi are also utterly unlike those of plants. There are a few plants that don't do photosynthesis, such as the parasitic flowering plant Monotropa uniflora. But these plants otherwise look like, and are built like, plants, and don't look or grow at all like fungi. Ironically, many plants, both photosynthetic and nonphotosynthetic, depend on root-associated mycorrhizal fungi for their survival and growth.

Megan then walks away, and Cueball, after pondering the mushroom a while further, gets up and walks away too. But as soon as Cueball has his back turned the mushroom growls after him. Cueball spins around to look back at the now again silent mushroom. This is a bit of absurdist humor; while mushrooms are technically more animal-like than plant-like, they are still so far removed from animals they wouldn't have any of the body parts needed to growl.[citation needed] Cueball's shock and astonishment is quite justified, and maybe it was just his imagination running wild after Megan's trivia. The reader is left to wonder what Cueball's next move will be - especially, those readers who have ever felt, or indulged, the urge to stomp mushrooms.

Another interpretation of the mushroom's growling is that mushrooms might be "fake" animals disguising as plants. The mushroom seems to be a plant, and acts very plantlike until Cueball looks away. The mushroom might have growled because it was planning on killing Cueball in a sort of "kill the witnesses" action. This comic might be hinting that mushrooms are evil and plotting the downfall of humanity under the disguise of "harmless" plants. Or, simply, mushrooms want to mess with other living things.

The title text takes this further, by stating that mushrooms are technically a type of ghost. Maybe because they arise from decaying remains. The title text may also refer to 1240: Quantum Mechanics or 1475: Technically, suggesting caution when dealing with a statement preceded by "technically." It may also refer to

the other name of Monotropa uniflora, "ghost plant" which hosts are certain fungi.

The title text might also refer to the behavior of ghosts (called Boos) in the Super Mario series, in that they only act or move when the player is facing away, as does the growling mushroom.

LIFE GOALS

- ☐ MEET SKRILLEX IN PHOENIX
- ☐ STUDY ZYMURGY
- ☐ GET A PET AXOLOTL NAMED HEXXUS
- ☐ OBSERVE A SYZYGY FROM ZZYZX, CALIFORNIA
- ☐ PORT THE GAMES ZZYZZYXX AND XEXYZ TO XBOX
- ☐ PUBLISH A ZZZAX/MISTER MXYZPTLK CROSSOVER
- ☐ BIKE FROM XHAFZOTAJ, ALBANIA TO QAZAXBƏYLI, AZERBAIJAN
- ☐ PAINT AN ARCHAEOPTERYX FIGHTING A MUZQUIZOPTERYX
- ☐ FINISH A GAME OF SCRABBLE WITHOUT GETTING PUNCHED

I got to check off 'Make something called xkcd' early.

Explanation

All visible goals except the last one on this to-do list feature one or more strange words containing an excess of the last three letters of the alphabet (X, Y and Z), often using several of them in the same words, even several of the same rare letter in a row. (See Table of life goals below).

All of these words can be looked up in the English version of Wikipedia, but only a few are common nouns, three of them weird animal names, the rest being proper nouns, i.e. persons names (fictional or artist) or obscure names for places or video games. The first goal is the one with fewest of these letters, only using two x's, and only the first word is strange, Skrillex being the artist's name of a musician. All later entries have at least three of these letters, which are most often used in very strange, often difficult-to-pronounce, words.

The punchline, in the final and ninth goal, expresses that the writer of this list often uses these unexpected and bizarre words in Scrabble games, which exasperates his opponents to such a great extent that he has yet to finish a game without getting punched. All of these words would theoretically earn a player many points in Scrabble, but outside of casual play it is not allowed to use proper nouns (see Scrabble points below).

In the title text, a reference is made to the fact that none of these goals have been checked off yet. It also turns out

that it is indeed Randall's list, since the writer of the list did (at least) manage to check off the goal Make something called xkcd early. Sadly there are neither y's nor z's nor even more than one x in that four letter combo.

This comic was published the week after the what if? article Flood Death Valley, which referred directly to the city Zzyzx in one of the pictures. It's the second comic in that week after the what if? post that references it more or less directly, the previous one being 1748: Future Archaeology. It seems likely that Randall created this comic after doing research for this what if? post, and came across the city Zzyzx as the shortest way to dig a channel to flood Death Valley.

Table of life goals[edit]

- The number of letters X, Y and Z is in the entire sentence.
- The total is the total number of these three letters in the entire sentence.

Scrabble points[edit]

All of these strange words would theoretically earn a player the prize of many points in Scrabble (Go to the table of words below). However, most of them would not be found in SOWPODS (the combined list of all words valid in either British or North American Scrabble tournaments). Also, many include too many X's, Y's or Z's (there's 1 X, 2 Y's, 1 Z in a standard set), meaning at least one would have to be substituted for a blank (which is not worth any points). Some words would also be very difficult to play in reality, since there are only 7 letters in a Scrabble hand, so

they could only be played in extremely rare circumstances (there are only a couple of ways to play MUZQUIZOPTERYX: for instance, from MU and OPTER; or MU, QUIZ and ER; or an astonishingly unlikely set of crossing letters). Many are long enough that, in theory, they could net the player the additional 50 point bonus for using all seven letters in a hand if played right.

• Explanation of the columns:

Word: With xyz

Definition: Of the word

Notes: Part of speech (noun or proper noun) and origin of the word

In SOWPODS?: Is the word a valid Scrabble word.

Enough tiles (...): Are there enough tiles in the standards English version of Scrabble to write the word?

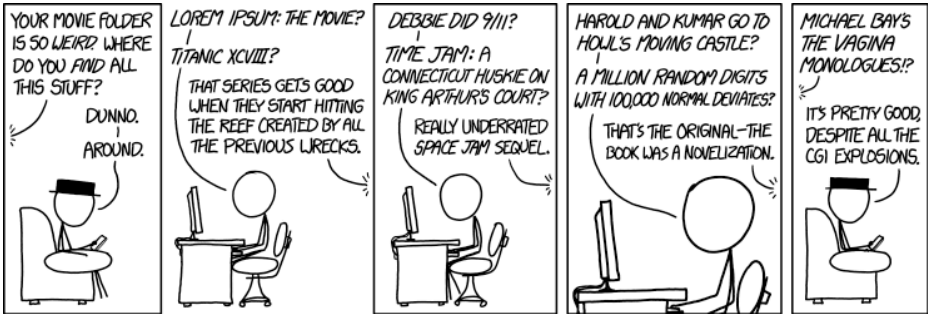Score: What would the maximum possible score in Scrabble be for this word. (Without any bonuses.)

Score (with blanks): What would the maximum possible score in Scrabble be for this word, taking into account the fact that some words need extra blank tiles, which aren't worth points.

50 points possible?: Is it possible to use all seven letters writing the word? If so it will give 50 points extra.

#1751: Movie Folder

October 26, 2016

Panel 1:
YOUR MOVIE FOLDER IS SO WEIRD. WHERE DO YOU FIND ALL THIS STUFF?

DUNNO. AROUND.

Panel 2:
LOREM IPSUM: THE MOVIE?

TITANIC XCVIII?

THAT SERIES GETS GOOD WHEN THEY START HITTING THE REEF CREATED BY ALL THE PREVIOUS WRECKS.

Panel 3:
DEBBIE DID 9/11?

TIME JAM: A CONNECTICUT HUSKIE ON KING ARTHUR'S COURT?

REALLY UNDERRATED SPACE JAM SEQUEL.

Panel 4:
HAROLD AND KUMAR GO TO HOWL'S MOVING CASTLE?

A MILLION RANDOM DIGITS WITH 100,000 NORMAL DEVIATES?

THAT'S THE ORIGINAL—THE BOOK WAS A NOVELIZATION.

Panel 5:
MICHAEL BAY'S THE VAGINA MONOLOGUES!?

IT'S PRETTY GOOD, DESPITE ALL THE CGI EXPLOSIONS.

That's actually the original Japanese version of A Million Random Digits, which is much better than the American remake the book was based on.

Explanation

Cueball is looking through Black Hat's downloaded movies, which are all adaptations of non-literary works, improbable sequels, and/or crossovers between very disparate properties. Cueball reacts with increasing incredulity to Black Hat's collection, while Black Hat casually responds with equally unlikely (non-)explanations. Knowing Black Hat, his movie folder is deliberately weird just to provoke this kind of reaction.

In the real world, there are movies which can provoke similar shock. For example, many successful films get direct-to-video (or, now, direct-to-digital) sequels and spinoffs, often featuring none of the original cast and which get very little marketing. Therefore, someone might be surprised to know that there's an American Psycho 2, a Starship Troopers 3, a Dr. Dolittle 5, or a Bring It On 5. Randall previously made fun of the proliferation of direct-to-video sequels in What If: Twitter Timeline Height, with at least 27 Land Before Time films (in reality, there were 14).

Another source of weird titles are mockbusters. When a film uses a public domain property as its basis, or a title that is too generic to trademark, other studios will simply create their own films and pretend that they're a sequel to the more famous film. Examples include Titanic II, Troll 2, Troll 3, the other Troll 3, Day of the Dead 2: Contagium, Alien 2: On Earth (not to be confused with

the real sequel Aliens) and War of the Worlds 2: The Next Wave.

Marketing wheezes have also produced some crossovers almost as unexpected as those in the comic — Abbott and Costello Meet Dr. Jekyll and Mr. Hyde, Scooby-Doo! WrestleMania Mystery and Jesse James Meets Frankenstein's Daughter are all real films.

A similar setting with Cueball and Black Hat also discussing movies was seen in 493: Actuarial. Back then Black Hat was still reading newspapers. Black Hat has previously given similar non-answers to long series of questions from Cueball in 908: The Cloud and 1159: Countdown.

Another type of comic where movie titles needs to be guessed from strange versions of the title was previously used in the Synonym Movies series.

Black Hat's downloaded movies[edit]

#1752: Interplanetary Experience
October 28, 2016

WHERE TO GO ON EARTH TO GET THE
INTERPLANETARY EXPLORER EXPERIENCE

PLUTO, MOON (NIGHT) MERCURY (NIGHT)	MT. EVEREST AT NIGHT
MOON (DAY)	MT. EVEREST AT NOON UNDER A TANNING LAMP
MERCURY (DAY)	A LAVA FLOW ON A VOLCANO AT NOON
VENUS	A HEAT-SHRINK WETSUIT IN A BLAST FURNACE
MARS	MT. EVEREST AT SUNSET
TITAN	WAIST-DEEP IN AN OUTGASSING SIBERIAN SWAMP
JUPITER-NEPTUNE	JUMPING FROM A HIGH-ALTITUDE BALLOON OVER AN ANTARCTIC OCEAN WINTER STORM

But instead of hitting the ocean, you should land in an overheating hot tub on a sinking cruise ship, sending it crashing through the floor into the burning engine room as the ship goes under.

Explanation

This comic lists ten celestial bodies: most other planets, the dwarf planet Pluto, as well as two moons, the Earth's Moon and Titan (the largest moon of Saturn). It then asks what places on Earth people could go to for a real Interplanetary Experience, as if they were explorers on these planets. It turns out that none of these ten other worlds are very nice to visit...

This is a parody on organizations that in preparation for future planetary exploration organize half-realistic experiments in human behavior on other planets, trying to emulate or mock-up - often on low budget - the conditions in which future explorers are to live and work. For this purpose, they build mock-up bases, habitats etc. in places that look like other planets or have the environmental conditions somewhat similar to other celestial bodies' surfaces. They seek out desolate places like deserts or polar regions for this purpose.

In this comic Randall tries to identify places on Earth that actually have environmental conditions as close to these other worlds' as can be possible on the surface of the Earth. Some of the places suggested by Randall are borderline-survivable for a human, but most will kill you extremely quickly without a lot of high-tech gear - whether through severe hypothermia (freezing), conflagration (fire), crushing (high pressure), or from violent winds.

Basically, nowhere in the solar system, except Earth, is even close to survivable (and there is actually only a very limited amount of Earth's surface where humans can actually live permanently). There is no planet or moon with a breathable atmosphere, or where the temperature stays within the human-tolerable range of roughly −20°C to 40°C (−5°F to 105°F, 250-310 K). It is also only with really good clothing and a place to stay at night that humans can live in a place much colder than 10°C for longer periods. The only place humans have so far ventured off-Earth is the Moon, and only during lunar morning while wearing thick pressurized spacesuits.

Some celestial bodies, like Venus and Jupiter, may never be visitable by humans without either huge advances in material science or full-scale terraforming (for Venus). Some places, like the centers of any planet (for example, the gas giants or even Earth itself), will probably never be visited, even by robots. (The title text suggests what happens when falling towards the center of a gas giant).

Below is a list going through the seven suggested places on Earth. Due to the low pressure and temperature on the top of Mount Everest it is mentioned no less than three times, but using different time of day to represent different celestial bodies. In the first entry it even takes care of three in one go. Two of those are the Moon and Mercury, but for both only on their night side facing away from the sun. They are thus each mentioned twice, as there is a huge difference in environmental conditions between the sunlit faces of these two and their night sides. On the other end of the temperature scale are

mentions of lava and a blast furnace; also high pressure environments are suggested to simulate other planets. The last goes for the gas giants, which are all mentioned together in the last entry.

The two groupings explains why there are only seven places mentioned for ten celestial bodies. The reason that the Moon is mentioned is of course that it is the closest companion to Earth and that we have actually visited it. That the only other moon mentioned is likely because it is the only really cold celestial body that actually has an atmosphere as well as a surface humans could stand on. But there are many other large moons that would be interesting to visit, like the Galilean moons especially Europa. But that could probably be compared to being on Pluto, except the sun is a bit larger. That Pluto is included as the only dwarf planet is probably because it was still a planet when Randall was a kid (see 473: Still Raw) and is the most recent (new) celestial body visited by a space probe at the time of release of this comic. This was celebrated by Randall in 1551: Pluto.

The title text is just a continuation of the last entry about falling down through the atmosphere of a gas giant, and it is also explained in the table below. This was also explored in the what if? article Jupiter Submarine.

"Seventeen, eighteen, nineteen, twenty--" / "Can't we just read Pat the Bunny?"

Explanation

Two small children, one a small Black Hat, sitting among their toys are playing thumb war. This is a common game for children, in which two players hold hands and attempt to pin each other's thumb down. The game is often started with both players chanting "one, two three, four, I declare a thumb war." In some variations, the chant continues counting up by an additional set of four, with a rhyme. Once the opening chant is complete, the game consists of trying to pin the opponent's thumb down. A pinned thumb must be held down for long enough to complete a count of four, or to complete the closing chant, "one, two, three, four, I won the thumb war".

The standard concept is subverted here: Young Black Hat interprets the simulation of hand-to-hand combat with thumbs differently, comparing it with real conflict. He shows this in further lines, invented by himself.

The second rhyme, "finger guns proliferate," is a pun on the finger gun gesture and describes small arms proliferation - the spread of black-market weapons which often comes with war as captured and smuggled guns make their way into the hands of paramilitary groups. Black Hat transfers this into the "thumb war universe", introducing finger guns into the thumb-to-thumb combat.

The third rhyme continues the counting until twelve and

mentions digits as in fingers, and states that they cannot protect themselves. This may be implying an imposition of firearms regulation or arms control as a response to the small-arms proliferation in the previous verse, or the defenseless nature of noncombatants in war.

In the last line Black Hat states that, even though this thumb war goes on and on, the "thumb U.N.", the thumb war universe equivalent of the United Nations (UN), won't intervene. In real life the UN would try to put an end to a given war by using diplomatic power and has the mandate of using (blue-helmet) peace forces in war zones to put an end to violence and give out a mandate to nations so that they can intervene in some crisis on their own behalf.

The thumb war game in Black Hat's version is instead a quite cynical portrayal of our world, criticizing the "might is right" mentality that is the sad reality of our globe, and the government of the world by the militarily strongest nations.

The other child, who will someday turn into Hairy, meanwhile, is unnerved by all this and wants to stop playing. Since Hairy is just a normal child he is really not interested in Black Hat's realistic version of what a war really is.

In the title text it seems like Hairy interrupts Black Hat's last rhyme after twenty, and finishes with his own rhyme, with "Bunny" ending in the same sound if you pronounce twenty like "twunny" as in some parts of the

world. So it goes like this:

Thus Hairy requests that they do something more appropriate for children, like reading a picture book - specifically, the "touch and feel" book for small children and babies known as Pat the Bunny. It isn't clear what Black Hat would have said if not interrupted.

This is the second time a young Black Hat has been used. The first was in 1139: Rubber and Glue. Black Hat has continued to make Hairy uncomfortable even as an adult, for instance in 1210: I'm So Random.

#1754: Tornado Safety Tips

November 02, 2016

TORNADO SAFETY TIPS

- AVOID LOW-LYING COOL AIR
- KEEP YOUR DOWNDRAFTS AND UPDRAFTS FROM MIXING
- SEEK OUT WARM AND HUMID SURFACE AIR LAYERS
- DON'T LET RAIN-COOLED AIR CHOKE OFF YOUR CIRCULATION
- AVOID LETTING YOUR SUPERCELL MERGE WITH A SQUALL LINE

It's a myth that you can never cross mountains safely, but be sure you understand how the climatic situation there will affect your parent thunderstorm.

Explanation

This is another one of Randall's Tips, this time a Tornado Safety Tip. Although this is clearly not a tip for humans but for tornadoes, a recurring subject on xkcd.

The comic features a Public Service Announcement (PSA) poster, which generally contain public-interest messages aimed at raising awareness or steering behavior around a specific issue of concern, that in this case contains tips for tornado safety. Typically, a poster labeled "Tornado Safety Tips" would be filled with instructions for how humans can stay safe in the event of a tornado, such as "stay away from windows," "go to the lowest floor of your home," "if in the open, take shelter in a ditch," and so on, see these examples: Example 1 (with same title as comic), example 2 and example 3.

Black Hat on the other hand, has flipped this on its head by publishing a poster that contains safety tips for the tornado itself and contains information for how tornadoes can stay safe, i.e., continue to exist; see the table of tips below. The joke is that just as, for example, a "climber safety" poster is directed at climbers, the "tornado safety" poster is directed at tornadoes.

It is thus in no way helpful for people who actually live in an area that experiences tornadoes or even for people that don't live in tornado-prone areas but want to be ready for their possible occurrence. It is not possible to follow most of the guidelines, as they are intended for

tornadoes. But the advice a human could follow would only take you towards places which can sustain tornadoes. Instead they should choose to use an app like the one in 937: TornadoGuard, but then first check if it actually works.
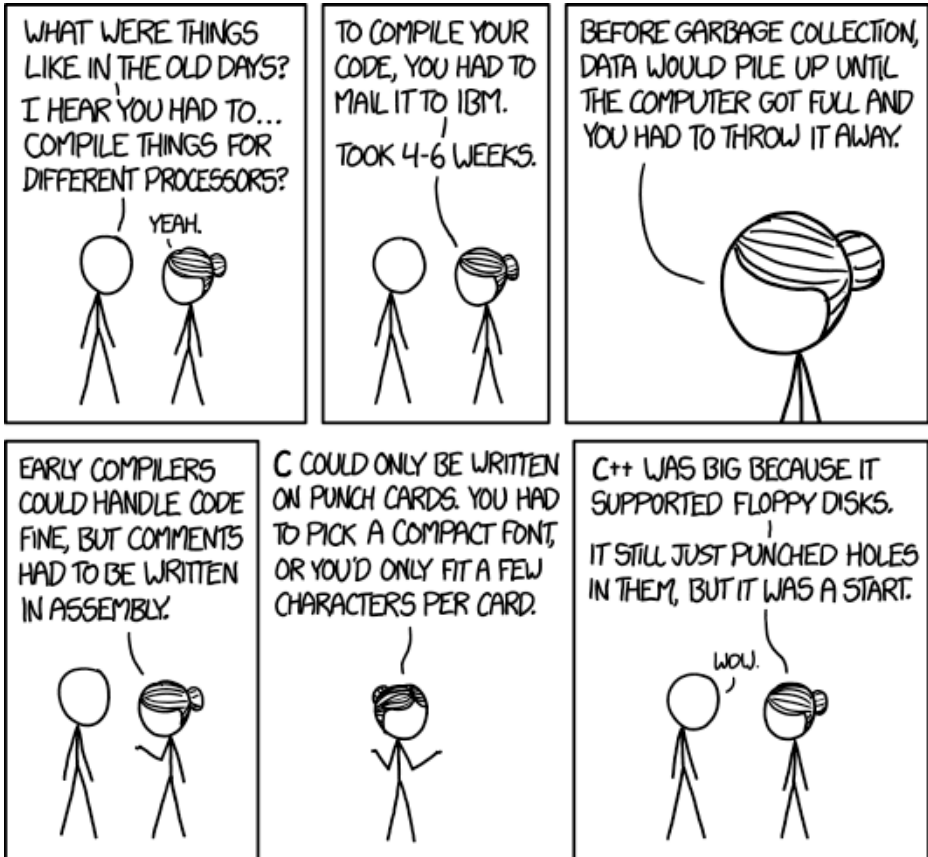
The title text simply adds more tornado advice for tornadoes, bringing up the common myth about tornadoes not crossing mountains, except from the tornado's perspective.

The tornado in this comic is similar to the picture used in the Tornado version of 1037: Umwelt.

Table of tips[edit]

#1755: Old Days

November 04, 2016

Lot of drama in those days, including constant efforts to force the "Reflections on Trusting Trust" guy into retirement so we could stop being so paranoid about compilers.

Explanation

This comic shows a conversation between (young) Cueball and (old) Hairbun about computer programming in the past, specifically compilers. Cueball, having a faint idea of just how difficult and byzantine programming was "in the old days", asks Hairbun to enlighten him on the specifics. Hairbun promptly seizes the opportunity to screw with his head. This later became a series when 2324: Old Days 2 was released more than 3½ years later. While her initial agreement that code needed to be compiled for multiple architectures is correct, Hairbun's claims rapidly grow ridiculous.

Hairbun tells Cueball a tall tale about how hard it was back in the old days, making it sound like some of the programming languages used today (C, C++) were written on punch cards and that you had to ship your code in the mail to a computer company (IBM in this case) to compile your code, which would take from four to six weeks. If there was a simple error, you would have to ship it again for another compilation.

This is, at best, a wild exaggeration, but is plausible to those who do not have the knowledge or context to challenge it, similar to a Snipe hunt, or several other cultural myths told about things like the Tooth Fairy. In some cases, decks of punched cards did have to be sent in to mainframe computers for processing, by people who didn't own their own machines. This wasn't generally the province of the computer manufacturers, nor were the

shipping times usually on the order of weeks, and professional programmers usually had better access to equipment. This can be contrasted with Kodak's first mass-marketed cameras, in the 1890s. Owners were expected to send their cameras back to the Kodak company for technicians to take out the exposed film, develop it and print off copies, which would be sent back along with the reloaded camera, to simplify the process of film handling in the relatively new consumer market.

It is clear from Cueball's final Wow that he falls for it. Hairbun then continues to explain more and more implausible so-called facts from the olden days.

What she says is true in that it was tough and slow to program on punch cards, which were actually used for an extended period of time. However, there is very little in the rest of Hairbun's story that is accurate, except that it was a big deal when the floppy disk was invented. The comment about punching holes in floppy disks is true. However, the nature and purpose of the holes punched this way was dramatically different than in punch cards. 5.25″ and 3.5″ floppy disks had holes or notches in them to indicate the data capacity and it was common to punch additional holes into cheaper, lower capacity floppy disks to trick the computer into writing more data on them than specified by the manufacturer. With punch cards, on the other hand, the holes themselves encoded the data so punching them was itself the act of programming. It is unclear if this was a coincidence, or intentionally included as a humorous aside to the readers who know the history as a misinterpreted truth in a sea of

falsehoods.

In the title text, Hairbun continues her musings on the old compiler days, stating that there was a lot of drama in those days. Specifically she references Reflections on Trusting Trust a famous 1984 paper by UNIX co-creator Ken Thompson in which he described a way to hide a virtually undetectable backdoor in the UNIX login code via a second backdoor in the C compiler. Using the technique in his paper, it would be impossible to discover the hacked login by examining the official source code for either the login or the compiler itself. Ken Thompson may have actually included this backdoor in early versions of UNIX, undiscovered. Ken Thompson's paper demonstrated that it was functionally impossible to prove that any piece of software was fully trustworthy.

Hairbun claims that one of the dramas she refers to was that people tried to force Ken Thompson to retire, so everyone could stop being so paranoid about compilers. In reality, any coder who created the first version of a compiler (or a similar critical component) could inject a similar backdoor into software, so it would be false safety. Even if no one else had thought of this, Thompson's paper was there for any future hacker to see. However, the problem was (claimed to be) solved in David A. Wheeler's Ph.D dissertation "Fully Countering Trusting Trust through Diverse Double-Compiling (DDC)".

#1756: I'm With Her

November 07, 2016

I'M WITH HER.
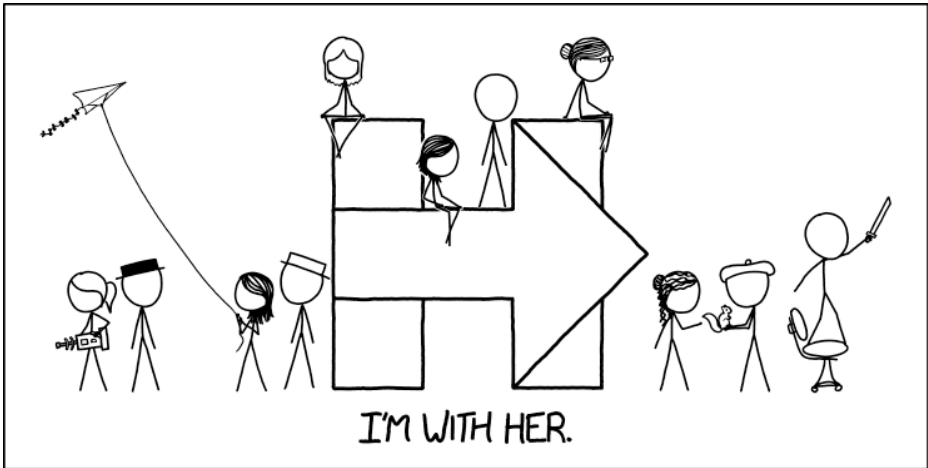
HOW TO HELP

VOTE —— iwillvote.com

GET A RIDE TO THE POLLS —— drive2vote.org

IF YOU'RE HAVING PROBLEMS VOTING —— 866-OUR-VOTE

EXPERIMENTAL SOCIAL ___ civicinnovation.com
TURNOUT PROJECT   APP STORE: VoteWithMe

REMINDER:
IF YOU'RE IN LINE WHEN THE POLLS CLOSE,
THEY HAVE TO LET YOU VOTE.

We can do this.

Explanation

In this serious, no joke, comic released the day before the 2016 United States presidential election (which was more contentious than most, due in part to many people finding both candidates unusually distasteful), Randall urged his American viewership to vote, and showed his endorsement for Hillary Clinton, the Democratic nominee in the election. She was up against the Republican nominee Donald Trump, who ended up winning. For the sake of completeness, it should be mentioned that there were also nominees from other parties, including Green Party nominee Jill Stein, and Libertarian nominee Gary Johnson. Neither hoped to garner enough votes to become president, but there was a chance they could affect the result in some states (no third-party candidate has won a state since 1968, and it did not occur this time either: the closest any came in 2016 was independent candidate Evan McMullin in Utah.)

It was the second time Randall referred to this election, the first being 1748: Future Archaeology three weeks before the election, but here it was just a wish to know the result using time travel (of course he did not learn the result back then...).

The "H" with an arrow was Clinton's campaign logo, and I'm with her an official slogan that was widely used by her supporters, hence the title. Randall then lists tips to help you cast your vote (see table below) suggesting a

personal investment in the election. Clinton herself may be represented by Blondie sitting on top of the H looking out at the reader as the only of the 11 characters. The only type of joke in the comic is the chosen characters. Two with weapons flank the left and right side looking out ready to defend against Trump: Ponytail with an emp gun (that she also wielded in 322: Pix Plz for melting computers of persons who make snide remarks at women, clearly a reference to allegations of Donald Trump's sexual harassment of women in general and especially to his grab them by the pussy comment) and Cueball with his sword (from 303: Compiling). See more details in the character gallery below.

This is the first time Randall has used a comic to directly support a presidential campaign, although he did endorse Barack Obama in 2008 on his Blag. At that time, Randall wrote that he was troubled by Hillary Clinton's "basic lack of integrity", which is interesting considering he later endorsed her. He wrote later that it was very controversial when he endorsed Obama, but that it was not the most controversial comic he had published at that time. This comic might take that prize now, given that this was one of the most discussed elections up to its time. This is particularly noteworthy outside the US—for example, some European leaders openly opposed Trump, while others supported him. There were also reports of Russian hackers attempting to influence the election.

Randall's support for Hillary Clinton may have been due in part to Donald Trump being a prominent climate

change denier. Randall has published comics opposing climate change denial such as this: 1732: Earth Temperature Timeline, published less than two months before the election, as well as several other comics on climate change. Also, Trump beating Clinton made Randall′s regex that matches the last names of elected US presidents but not their opponents impossible to update. All the information on the bottom half of the comic includes sites, numbers, info, etc., current as of 2016, that are intended to help US voters to vote, regardless of whom they vote for. Including this information can assist voters who don′t understand the process, don′t feel that it′s worth it, or feel intimidated or threatened. In general, these sites and numbers were likely included to help boost voter turnout.

The title text, ″We can do this″, refers to Randall′s desire to unite Democratic voters and elect Hillary Clinton to the White House instead of Trump. One can buy T-shirts with the famed ″We Can Do It!″ logo from the Rosie the Riveter wartime poster, but with Hillary Clinton in the famed position. Both resemble the former president Barack Obama′s campaign slogan Yes We Can and German Chancellor Angela Merkel′s ″Wir schaffen das″ (We can do this) refrain during the Syrian War refugees influx the year earlier—like Clinton, Merkel was fighting against a populist nativist movement that wanted to close the country′s borders. Although the title text wasn′t originally meant as a joke, we in the future, aware of the election results, can extract humor from it in the form of dramatic irony.

How to help[edit]

The list of things that can help is all about getting people to vote. While Randall is likely to have wanted to boost voter turnout regardless of political leanings, it's clear from his endorsement of Clinton that he believed increased turnout would have helped her win the race. There is general evidence that certain more heavily Democratic-leaning demographics are less likely to vote, and in this election in particular, the various political issues that had been raised against Hillary (such as the FBI's public disclosures of its investigation into her use of a private email server) were shown to have reduced enthusiasm among Democrats. But all these issues aside, both Republicans and Democrats alike agree on encouraging everyone to vote, and Randall is likely to have agreed with that sentiment as well.

Here is Randall's list of suggestions for how to help Hillary Clinton win the election:

Character gallery[edit]

The comic shows a gallery of 11 xkcd characters including all the main characters from xkcd (except Hairy), which stand united behind Randall and Clinton despite their lack of agreement in many other comics.

From left to right on the left side of the H are

- Ponytail with a ray gun that she wielded in 322: Pix Plz (wherein she was named Joanna), for the purposes melting computers of persons whom make snide remarks at women. Possibly a reference to Donald Trump's alleged sexual harassment of women.

- Black Hat, who was the one introducing Joanna/Ponytail in the mentioned comic

- Danish, Black Hat's girlfriend setting up a kite, although it could be Megan, but she is also shown later with her regular shorter hair. However, it has mainly been Megan in comics with kites, like 235: Kite and 1614: Kites. Kites are a recurring theme on xkcd.

- White Hat looking at the kite.

On top of the H are

- Blondie, (looking out at us, maybe representing Clinton herself)

- Megan, (next to Cueball)

- Cueball, (forming the standard couple in xkcd with Megan)

- Hairbun with glasses (so specifically not the one from the previous comic 1755: Old Days, but rather like in 1637: Salt Mine).

On the right side of the H are

- Hairbun without glasses holding her hand out towards a cute squirrel. This could be a reference to 635: Locke and Demosthenes, where the squirrel is poisoned.

- Beret Guy holding a squirrel out towards Hairbun without glasses. The first time squirrels were mentioned was actually when Beret Guy found them in a tree in 167: Nihilism and since then they have become a recurring theme on xkcd and a similar squirrel can for instance be seen in 1503: Squirrel Plan.

- Another Cueball standing on an office chair wielding a sword as in 303: Compiling. Interestingly enough the previous comic

1755: Old Days was about Cueball asking Hairbun about compiling in the old days. Seems realistic that Randall has this comic ready for this Monday before the election for some time, and when finding this 9-yeared version of Cueball in the old comics, he may have gotten inspired to make a comic about compiling in the old days.)

Note that the two characters at either side of the comic wield weapons pointing out, defending the other nine. Those next to the characters with weapons are doing recreational things like kiting and admiring adorable squirrels, both of which are recurring subjects in xkcd.

#1757: November 2016

November 09, 2016

THE NOVEMBER 2016
GUIDE TO MAKING PEOPLE
FEEL OLD

IF THEY'RE [AGE], YOU SAY:

"DID YOU KNOW __[THING]__ HAS BEEN
AROUND FOR A MAJORITY OF YOUR LIFE?"

AGE	THING
16	GRAND THEFT AUTO IV
17	RICKROLLING
18	*AQUA TEEN HUNGER FORCE COLON MOVIE FILM FOR THEATRES*
19	THE NINTENDO WII
20	TWITTER
21	THE XBOX 360, XKCD
22	CHUCK NORRIS FACTS
23	OPPORTUNITY'S MARS EXPLORATION
24	FACEBOOK
25	GMAIL, *PIRATES OF THE CARIBBEAN*
26	IN DA CLUB
27	*FIREFLY*
28	THE WAR IN AFGHANISTAN
29	THE iPOD
30	*SHREK*, WIKIPEDIA
31	THOSE X-MEN MOVIES
32	*THE SIMS*
33	AUTOTUNED HIT SONGS
34	THE *STAR WARS* PREQUELS
35	*THE MATRIX*
36	*POKÉMON RED & BLUE*
37	NETFLIX, *HARRY POTTER*, GOOGLE
38	DEEP BLUE'S VICTORY
39	TUPAC'S DEATH
40	THE LAST *CALVIN AND HOBBES* STRIP
41	*TOY STORY*
>41	[DON'T WORRY, THEY'VE GOT THIS COVERED]

Once you've done this, make a note of how old they were.
Then, when their age reaches double that, show them this
chart again.

Explanation

This is yet another comic designed to make people feel old, following soon after the last one 1745: Record Scratch.

The comic takes the form of a table of ages between 16 and 41, and next to each, a list of things that originated approximately half that age ago. Thus, by mentioning those things to a person of that age, that person becomes aware that those things have now been around for the majority of their life. People tend to underestimate how long ago things happened, so the revelation will usually come as a shock and make them realize that things they think of as new and modern are actually a lot older than they thought. This, in turn, will make them feel old.

For example, if talking to a 24-year-old, the relevant sentence would be:

To a 24-year old, Facebook likely still seems like a new innovation, so they may be shocked to discover that it has been around for more than half their life.

The joke at the end is that the guide isn't necessary for people over 41, since they already feel old, and are more than capable of providing any number of demonstrative examples.

It should be noted that the guide is only current for the time it was published, which is why it is billed as the "November 2016 Guide to Making People Feel Old".

This is because the examples given in the table are relative to a person's age at that time. However, the title text sneakily suggests a way to get an additional use out of the guide: by noting down the person's age at the time you show them the guide, and then showing it to them again when they are double that age, they will realize that more than half a lifetime has elapsed since the last time they viewed this comic, and will thus feel old again.
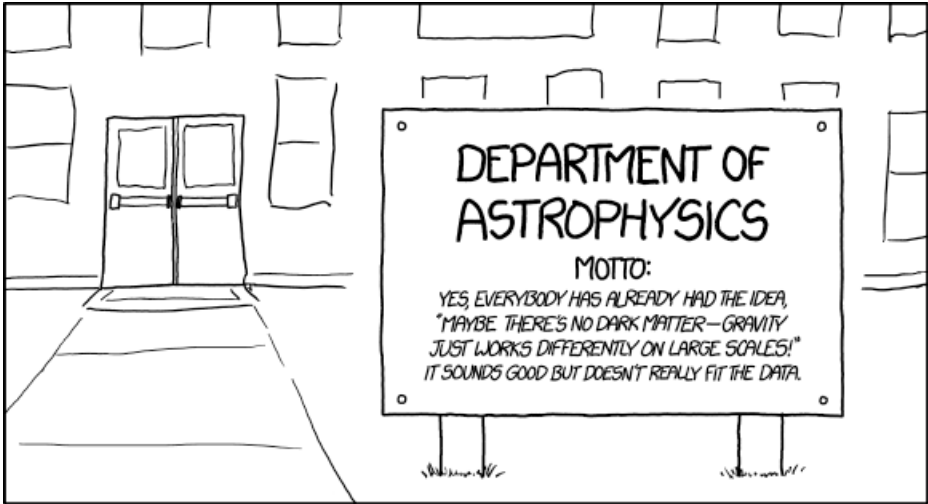
DEPARTMENT OF NEUROSCIENCE / Motto: "If I hear the phrase 'mirror neurons' I swear to God I will flip this table."

Explanation

In physics, the theory of gravity produced by general relativity combined with dark matter are our current best model for explaining the behavior of gravity and galaxies. The evidence supporting this model is extensive. General relativity accurately predicts the orbit of planets, even precise details like the precession of Mercury which Newtonian gravity couldn't fully explain. Dark matter, in turn, explains behaviors of galaxies such as their rotation rates that were not correctly predicted with general relativity alone. Most astrophysicists believe dark matter exists, either in the form of an unknown type of star that is too dim to see, or an undiscovered subatomic particle.

However, because the concept of dark matter posits something so pervasive yet unknown and so far undetected, it can be difficult to accept, since typically inability to detect something tends to mean non-existence of that thing. One might be reminded of Aether, a similar theory that an undetectable substance exists in space to allow light and gravity to travel, although unlike dark matter that has been debunked. Thus, it is common to hear objections to dark matter, with a popular alternative idea being that dark matter can be explained away by a modified theory of gravity.

One such alternative theory which gets proposed regularly is modified Newtonian dynamics (MOND). In MOND, gravity doesn't simply follow the inverse square

law but has more complicated behavior. Usually, the extra behavior is either to say that gravitational force can be affected by the acceleration of the particle, or that it goes from inverse-square to just inverse at large distances. It can be appealing because it's relatively simple and seemingly more logical — it just changes our understanding of Newton's law of gravitation, rather than requiring entirely new forms of matter or unknown stars to exist — and because it has some nice side-effects, such as explaining why there seems to be a limit on the density of galaxies. Unfortunately, physicists have explored this avenue and cannot reconcile it with all existing data. One famous counterexample is the Bullet Cluster, where two colliding galaxy clusters are ripping through each other. The mass distribution within the cluster can be inferred through gravitational lensing, and appears to show dark matter and ordinary matter being separated to a certain extent which cannot be explained with MOND. Another counterexample is MOND's incompatibility with observations of the motion of galaxies in galaxy clusters. More generally, MOND isn't compatible with general relativity — which has a huge amount of experimental data in its favor — and a MOND-compatible general relativity would be very complicated and ugly.

This comic illustrates physicists' exasperation for people who constantly try to challenge the existence of dark matter without considering all the evidence and theoretical foundation that support it. Apparently members of this department are so tired of hearing the

same old ideas being repeated to them, that they have adopted a motto and even erected a sign in an attempt to clear the dissuasion. The specific impetus for this comic may be the press coverage around this publication by Erik Verlinde (see popular description of the paper here). It was released online three days before the release of this comic and got a lot of coverage exclaiming "this will prove Einstein wrong". While Verlinde's work on entropic gravity is a serious theory derived from thermodynamics and quantum information theory, it is important to keep in mind that it's just a pre-print and hasn't been peer-reviewed or experimentally verified yet. Verlinde's theory also doesn't match all available data - it disagrees with experimental results showing how particles interact with gravity. Thus, it is still a far cry from being a contender for replacing dark matter.

The title text alludes to a similar issue faced by the Department of Neuroscience from popular misconceptions of Mirror neurons. Mirror neurons are brain cells which trigger when watching someone else do something. Experiments claim to have found mirror neurons in humans and apes, and there are theories that make mirror neurons the foundation of learning, empathy, language and consciousness itself. However, the evidence for mirror neurons is still patchy, and even if they exist, it's very simplistic to try to attribute so much of human behavior to a single type of relatively simple cell. In light of this, the motto of the neuroscientists at the department rightfully reflect their frustration. Flipping tables is a common depiction for expressing

extreme outrage. It is used here also as a pun because mirrors flip the image in front of them.

Another story of similar press coverage questioning the current established scientific theory was also mentioned two days before the release of this comic, on the YouTube channel Space Time from PBS Digital Studios in their video titled Did Dark Energy Just Disappear?. This one was regarding the paper Marginal evidence for cosmic acceleration from Type Ia supernovae. The video concluded that dark energy is still the best explanation. Note this is about the existence of dark energy rather than dark matter. The two are very distinct concepts.

Science papers with results that supposedly disprove solidly founded theories have been the subject before in 955: Neutrinos.

#1759: British Map

November 14, 2016

West Norsussex is east of East Norwessex, but they're both far north of Middlesex and West Norwex.

Explanation

This comic is a joke similar to "How Americans see the world" showing how the average American has opinions on the world, often including jokes such as a lack of Africa, etc. This has been used before in 850: World According to Americans. The map also plays with the joke by noting it has been labeled by a specific American rather than "Americans".

Many areas of the UK are most familiar to foreigners thanks to their depiction in various fantasy novels and TV series. This map labels some of these, as well as including many silly names that simply sound like real British towns to an American ear. A protractor is shown off the coast of the Mull of Kintyre in reference to the "Mull of Kintyre test" - according to urban legend, the angle of the Mull defines the maximum allowed erectness for a man on films and home video releases in the UK.

Randall previously posted a map of Great Britain on his blog as part of the promotion for his book What If?. This map is from a very similar position and appears to have been traced from the same source, although there are some slight differences. Both maps include a sketch of Lake Windermere with boats on it, and both have the locations of London, Oxford and Cambridge labeled (the blog map also shows Edinburgh and Bristol - in this comic, these are labelled Eavestroughs and Minas Tirith). Both also contain references to Stonehenge and Watership Down.

Note that in British English, the correct spelling of "labeled" is 'labelled'.

The title text plays around with the concept of the compass directions and how numerous regions (such as South "Sussex" and West "Wessex") incorporate such literal names in their description. Randall is creating similar sounding names which are nonsense-ish ("Norsussex" would be the region of the Northern-Southern Saxons), and placing them in relation to each other in ways which would be geographically implausible, similar to this old joke about Boston. However, in Germany there exists the region called Westphalia (Westfalen), and the eastern part of it is often referred to as East-Westphalia (Ostwestfalen), which sounds somewhat ridiculous. Part of the joke in the title text could be the fact that while three of the locations are fictional, Middlesex does actually exist.

#1760: TV Problems

November 16, 2016
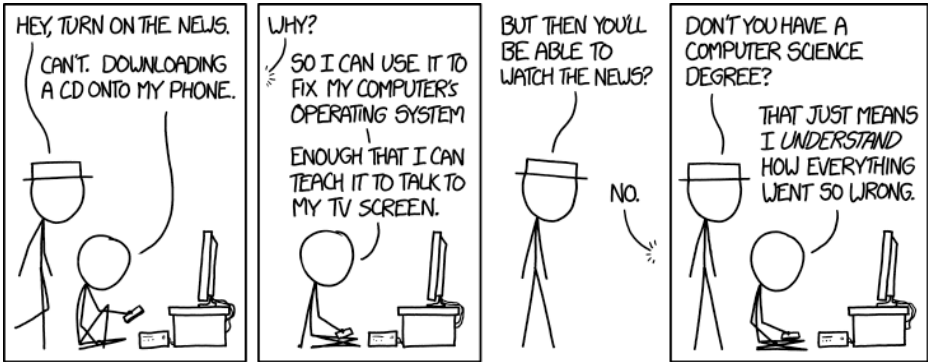
Certified skydiving instructors know way more about safely falling from planes than I do, and are way more likely to die that way.

Explanation

In this comic, Cueball has broken his computer's software so much that he is unable to "turn on the news" as requested by White Hat. Since his computer is not working at all, he is using the next best thing to download a fix: his smartphone, via a CD. This is probably one of two things:

He later states that even that first step of mending won't be enough to display the news, as his computer's state is so bad that being able to send information to the TV screen is just the first step of debugging. In the last panel, he tells White Hat that his computer science degree just helps him understand how he ended up with such a terrible situation, but did not give him enough foresight to prevent the most unexpected issues. The title text clarifies this statement with a similar problem- when things start to go horribly wrong while falling from a plane, certified skydiving instructors will be able to better understand why and how bad the situation is, but won't be able to do anything if their usual tools have failed them. Besides, while they are less likely to make a fatal mistake on a given flight and fall, they are more likely to make one in their life, because of the far greater number of attempts. This is especially true considering most people never attempt a jump in their lives, giving them nearly zero probability of dying in a skydiving accident. This also resembles 795: Conditional Risk: the more informed a person is, the more likely this person is to suffer from the issue they know about.

Computers breaking in unexpected ways, and somewhat weird solutions to computer problems seems to be a thing with Cueball - and probably Randall as well. At that point, you might assume he probably enjoys it. In 1586: Keyboard Problems, he also had a problem involving both software and hardware. 1739: Fixing Problems could very well apply to this comic; Cueball may have ended with this situation while trying to correct a simple problem (eg: channels in the wrong order), and just made the situation worse every step of the way. In 456: Cautionary, he teaches his cousin about breaking fixing a computer.

In this instance Cueball has his single tasking phone busy while he downloads to it and cannot interrupt what he's doing just to use the phone as a remote for the TV, although it appears more that the TV is one of the things he is trying to fix.

#1761: Blame

November 18, 2016
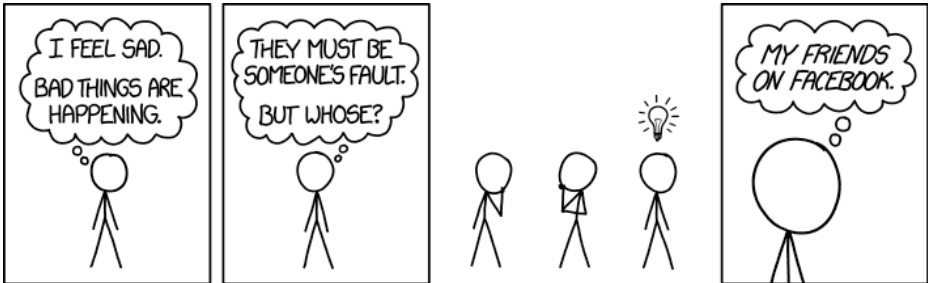
I bet if I yell at my scared friends I will feel better.

Explanation

Cueball is blaming his "friends on Facebook" for "bad things [that] are happening".
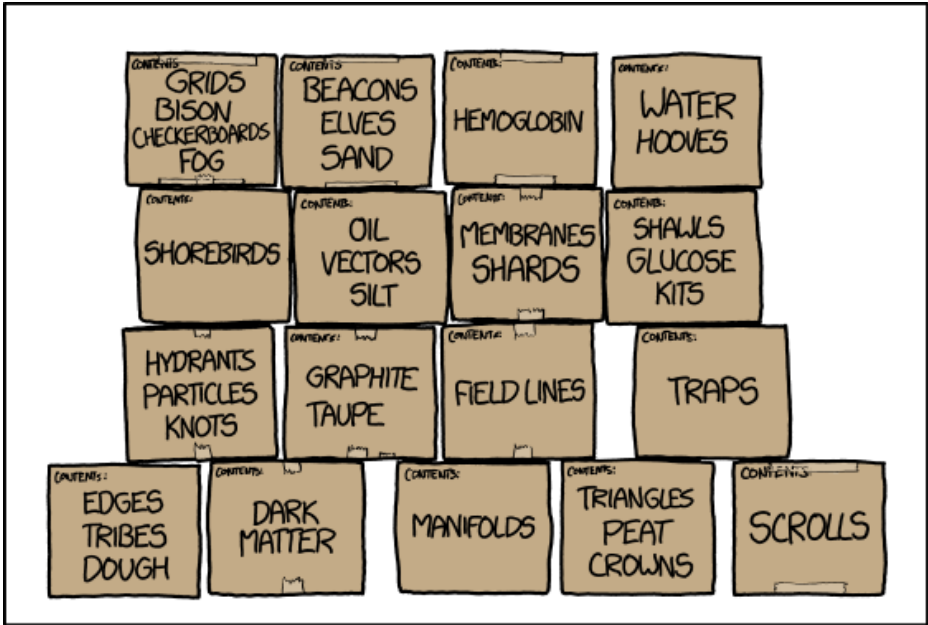
People often rant on social media sites (like Facebook) about various things which are blamed on certain people (or sometimes usually everyone), but the person doing the ranting never thinks that the problem might be with themselves.

While there could be possible reasons for bad events (for example if the bad event was nobody wishing him a happy birthday or someone posting compromising pictures), his friends would not be a likely source for bad events extending beyond a personal or local scope. Most people have a few hundred (or thousand) "friends" on Facebook, most of whom do not have enough influence to cause bad events on a national or global level.[citation needed]

The title text refers to people venting. The humorous assumption here is that one will feel better after doing so. While some amount of venting might help to relieve stress caused by bad events, alienating people you know by blaming them for bad events usually causes more stress in the long run.

#1762: Moving Boxes

November 21, 2016

CONTENTS: GRIDS BISON CHECKERBOARDS FOG

CONTENTS: BEACONS ELVES SAND

CONTENTS: HEMOGLOBIN

CONTENTS: WATER HOOVES

CONTENTS: SHOREBIRDS

CONTENTS: OIL VECTORS SILT

CONTENTS: MEMBRANES SHARDS

CONTENTS: SHAWLS GLUCOSE KITS

CONTENTS: HYDRANTS PARTICLES KNOTS

CONTENTS: GRAPHITE TAUPE

CONTENTS: FIELD LINES

CONTENTS: TRAPS

CONTENTS: EDGES TRIBES DOUGH

CONTENTS: DARK MATTER

CONTENTS: MANIFOLDS

CONTENTS: TRIANGLES PEAT CROWNS

CONTENTS: SCROLLS

I ALWAYS FORGET TO LABEL MY MOVING BOXES UNTIL THEY'RE SEALED UP AND I'VE FORGOTTEN WHAT'S IN THEM.

Later, when I remember that I'm calling movers, I frantically scribble over the labels and write 'NORMAL HOUSE STUFF' on all of them, which actually makes things worse.
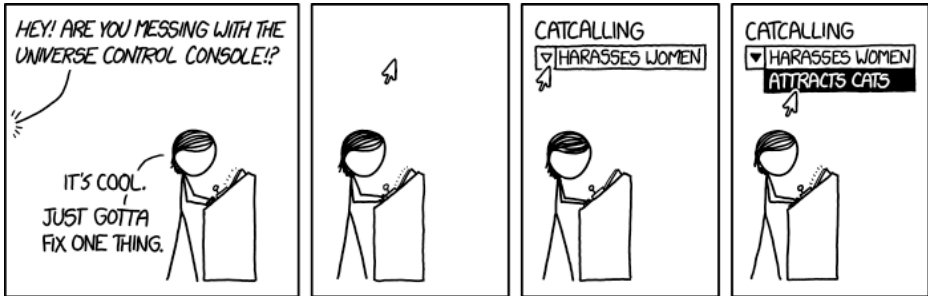
Explanation

Randall talks about moving boxes and not labeling them until he forgets what's in them. Since he doesn't know what's in them, he writes silly things on the boxes as a joke. Some things are unusual/unlikely (e.g. sand, hydrants, peat) and some are abstract/impossible (e.g. elves, taupe, dark matter). Several of the categories overlap confusingly; for instance, "sand" and "silt" and "dark matter" are all generally considered as "particles"; "membranes", "edges", and "shawls" are all kinds of "manifolds"; "hooves" are part of "bison"; "fog" contains "water"; and "triangles" consist of three "edges". Another way to interpret this comic is that Randall actually has these items (or at least some of them) in the boxes and has simply forgotten which boxes contain what.

According to the title text, when Randall remembers that he is calling movers, he frantically scribbles "Normal House Stuff" on all the boxes. He says this makes the situation worse, possibly because the movers see the scribble and become suspicious. Alternatively, labeling every box with the exact same phrase will make it even harder to figure out what they contain and where they should go in the new dwelling.

Explanation of boxes[edit]

#1763: Catcalling

November 23, 2016

Effect strength => [unstoppable]|Effect range => [2 miles]|Effect duration => [1 year]

Explanation

"Catcalling" refers to the act of whistling or shouting to express sexual interest in a person, and often constitutes harassment. Annoyed by this practice, Megan alters the Universe Control Console to create a setting in which catcalling actually attracts cats (as the name implies), thus resulting in the catcaller being harassed by the overwhelming feline presence, instead of the other way around, likely in an attempt to discourage the act.

When read without the title text, it could be assumed that Megan is trying not to punish catcallers, but to turn catcalling into a positive thing, since after the change is made catcalling will no longer offend women and instead attract the attention of cats, an animal many people on the internet find cute.[citation needed] It is only with the clarifying information in the title text that it becomes clear that Megan is trying to punish catcalling, thus changing the joke.

It is interesting to note that changing what women find insulting/harassment would involve fundamentally changing their psychology on some level. How exactly the Universal Control Console will make them immune to this specific behavior is unclear. The Universal Control Console is an intentionally ambiguous device, but based on how Megan and Ponytail used it in 1620: Christmas Settings, it may change people's memories of what reality was like before a change, so using the catcalling example, it might make everyone in the

universe forget what catcalling initially was, thus removing the insult of even trying to do it in the first place.

The "Universe Control Console" was introduced in 1620: Christmas Settings as the "Universe Control Panel", where it was used to control aspects of reality related to Christmas. Based on the name, it is presumed all aspects of reality could be altered using this fictitious device. The pointer arrow and menu options shown above Megan appear to depict aspects of the user interface that Megan is seeing. In 2240: Timeline of the Universe someone hit the inflation switch starting the inflation again. And then someone stopped this by hitting the emergency stop. These must also be on the Universe Control Panel.

The Console appears to have been modified/upgraded since its last appearance and features fewer controls while gaining a joystick in this incarnation. It also appears that Megan has learned to operate the console better since first encountering it. (Ponytail, who first demonstrated the console to Megan, may be the offscreen voice in this comic.)

Furthermore, the title text suggests that catcalling now attracts all cats within two miles for an entire year. The prospect of being piled in cats for a year would discourage people from catcalling by a large amount.[citation needed] 1156: Conditioning also persuades people to change behavior related to wildlife.

The redefining of terms related to sexual harassment as more innocent things has also been discussed in 1178: Pickup Artists.

Also, the cursor on the console is left-handed for some reason.

#1764: XKCDE

November 25, 2016

INSTALLING THE XKCD DEVELOPMENT ENVIRONMENT

1. SPIN UP A VM

2. SPIN UP A VM INSIDE THAT VM

3. CONTINUE SPINNING UP NESTED VMs AND CONTAINERS UNTIL YOU GET FIRED

4. They unplug the root machine but the thousands of leaf VMs scatter in the wind and start spinning up new instances wherever they land

Explanation

Randall has created a theoretical software environment named XKCDE (a portmanteau on xkcd and CDE (Collaborative Development Environment)), which relies on the user creating a series of nested virtual machines inside each other (creating sort of a digital version of the Droste effect), which would likely cause extreme strain on the resources of the machine running it. This strain is explained in 676: Abstraction, at least for the normal case.

"Virtual Machines" are software which pretend to be PC hardware so that a "guest" operating system can run inside of them, under a "host" operating system. Nesting VMs is the process of making a guest also be a host to yet another guest. Generally this is considered wasteful of resources, especially beyond one or two layers deep, and is not done except in a test lab for very specific purposes.

"Containers" are a lighter form of PC abstraction. Instead of emulating the entire physical hardware, they only emulate the software stack sitting on top of the kernel. A containerization tool will have its own standard library, software-stack and installed programs, but delegates all system calls to the host kernel.

This is more efficient because no hardware needs to be emulated, but the disadvantage is reduced isolation between host and guest. A misbehaving guest can induce kernel crashes that take the host with them.

The most well-known example of container software is Docker.

Randall derives humor from repeating the nesting ad absurdum in a never-ending fractal of nested VMs, thus trapping the follower of the instruction forever, in a form of Nerd Sniping: Any external observer, such as your boss, who sees you doing this is likely to fire you for wasting company time (an outcome which is undesirable, though still better than being hit by a truck).[citation needed]

A software environment which disables both the machine it runs on and the user that runs it could be thought of as a useless machine.

The title-text is a joke on the words root and leaf as used in abstract data structures, drawing an analogy of cutting down a tree (unplugging the root machine) scattering leaves (the nested VMs).

A subtle pun is hidden in 'spinning': several tree species use spinning leaves to scatter their seeds. The autorotation due to the special shape of the leaves helps the seeds travel farther on the wind from their parent tree. Randall mixes this meaning of 'spinning' with the act of "spinning up a VM", the colloquial phrasing for starting up a new instance of a guest virtual machine.

As a seed grows into a new tree where it lands, so apparently do the scattered VMs spin up new instances of themselves wherever they land.

In this case, a literal interpretation would be that turning off the computer the VMs are running on would make all the VMs without any VMs running in them propagate themselves through a network and install themselves on other computers, which at the end of the day would be a very inefficient method of creating a virus.

Real Life Practice[edit]

In 'normal' software development, spinning up a (single, non-nested) VM is a practice to ensure that the development environment is identical between developers, thus minimizing hard-to-reproduce bugs due to local machine differences, such as unmatching library versions, locale settings or additional installed or missing software.
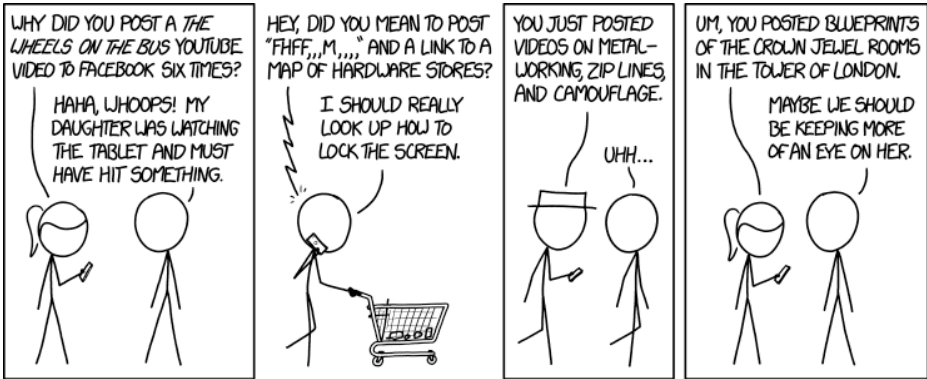
The single VM image is shared between all developers, who each spin up their own instance on their personal workstation.

In such cases, spinning up the VM is the first step in bringing up a local development environment, after which additional steps will usually instruct which programs to open, which configuration settings to change, etc.

Someone got 4 levels deep with this.

#1765: Baby Post

November 28, 2016

Panel 1:
WHY DID YOU POST A *THE WHEELS ON THE BUS* YOUTUBE VIDEO TO FACEBOOK SIX TIMES?

HAHA, WHOOPS! MY DAUGHTER WAS WATCHING THE TABLET AND MUST HAVE HIT SOMETHING.

Panel 2:
HEY, DID YOU MEAN TO POST "FHFF,,,M,,,," AND A LINK TO A MAP OF HARDWARE STORES?

I SHOULD REALLY LOOK UP HOW TO LOCK THE SCREEN.

Panel 3:
YOU JUST POSTED VIDEOS ON METAL-WORKING, ZIP LINES, AND CAMOUFLAGE.

UHH...

Panel 4:
UM, YOU POSTED BLUEPRINTS OF THE CROWN JEWEL ROOMS IN THE TOWER OF LONDON.

MAYBE WE SHOULD BE KEEPING MORE OF AN EYE ON HER.

[bzzzt] "REMEMBER TO CHECK IN FOR YOUR FLIGHT TO LONDON." "My wha-" [bzzzt] "YOUR UBER WILL ARRIVE IN FOUR MINUTES."

591

Explanation

In this comic, Cueball is questioned about a series of posts made to his Facebook account. He explains the posts as the result of leaving his daughter (a baby, according to the title) unattended with his tablet. This is very common for parents with small children in modern times. Children tend to be fascinated with touchscreen devices, which include many entertainment options for small children (such as the mentioned "Wheels on the Bus" video). Infants also tend to experiment with such devices, and frequently open apps, post links, and make calls without intending to.[citation needed] This explains the first two panels: sharing the same video six times could be the result of the child repeatedly hitting the same area of the screen (such as a "share" link), and the gibberish text "FHFF,,,M,,,," could be due to the child randomly tapping on the screen, all without knowing what she was doing.

The joke begins when Cueball discovers an apparent pattern in the new posts, starting with a map of hardware stores and culminating in blueprints for the Tower of London. These subjects, if they were chosen consciously by an adult, would strongly suggest the poster was planning a heist to steal the Crown Jewels, which have a reputation, based in part on several movies (for example, Minions), for being overly complicated to steal. It is very unlikely for a baby to be capable of designing and carrying out such a plan,[citation needed] but it is also unlikely for these specific links to be posted all by

accident. Cueball seems genuinely perplexed by the links (and presumably wouldn't have posted them if he were planning the crime himself), so the reader is left wondering what could have caused these posts, and whether Cueball and/or his daughter might know more than they let on. Cueball's suggestion of "keeping an eye" on his daughter suggests he is seriously considering the possibility that she might be an evil genius.

The title text continues the joke by notifying Cueball that his flight to London is leaving soon, and an Uber driver is coming to pick him up. Since his daughter was using the tablet and he is surprised by the messages, this suggests she is in fact the mastermind who has already started executing her plan. Either she is making the journey herself (and Cueball is only receiving notifications because he has the same accounts linked to his phone), Cueball is being roped into the crime, or his daughter is deliberately making it look like he intends to steal the Crown Jewels in order to get him into trouble.

The crown jewels are also mentioned in 1698: Theft Quadrants. The comic is similar to 1419: On the Phone, though there it seems that the daughter isn't just a cover story for Cueball. It is also somewhat similar to 576: Packages, in that Cueball seems weirder since it started.

#1766: Apple Spectrum

November 30, 2016
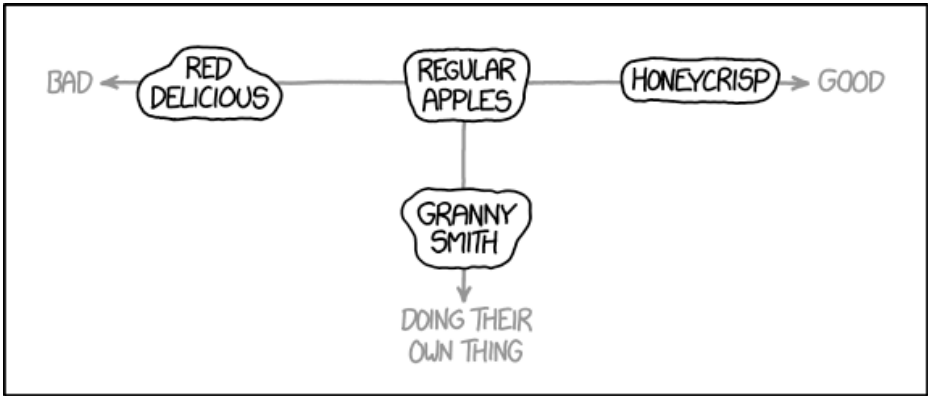
If I were trapped on a desert island, and could have an unlimited supply of any one type of apple, I'd be like, "How did this situation happen?"

Explanation

The comic shows a spectrum of different types of apples, with Red Delicious towards the bad end of the spectrum, and Honeycrisp towards the good end of the spectrum. Although most spectra are only one-dimensional, Granny Smith is on some side branch, implying that the taste is so different from the other two that it deserves its own category. (Granny Smith apples have a distinctively tart, or sour, flavor with a subtle sweetness, and is commonly used for cooking, as opposed to the other mentioned varieties that are quite sweet and primarily eaten raw.) Randall has previously shown his disdain for Red Delicious apples in footnote 1 in this what if; he also ranked green apples as tastier than red apples in 388: Fuck Grapefruit. The labeling of Red Delicious as "bad" compared to apples in general is perhaps unwarrantedly uncharitable; most apple trees produce fruit so bad that it is considered unfit for any purpose but fermentation.[actual citation needed] On the rare occasions that a tree naturally produces palatable apples, it is grafted onto other trees so that they will produce more of its apples instead of their own--all Granny Smiths are genetically identical. For a long time, though, in the US apples were mainly divided into three sorts. In case of the Red Delicious apples the color, not the taste was deemed most important to the buyers which (along with the genetic variability of Red Delicious) led to many Red Delicious apples breeds that looked great, but actually tasted bad, leading to a big restructuring of the

apple market.

In the title text, Randall observes a common type of hypothetical question designed as a creative way to inquire about a person's preferences: If he were on a desert island with an unlimited access to something they like -- in this case, unlimited supply of any one type of apple -- what would he choose? However, Randall gives an unorthodox and unexpected answer to the typically playful hypothetical by taking it literally and questioning how such a situation would occur. How did he get stuck on the island, and how did he get a literally unlimited supply of apples? In reality, a desert island is unlikely to have an unlimited supply of any food,[citation needed] let alone apples.

Randall's opinions on Red Delicious apples were referenced again in the title text for 2820: Inspiration.

#1767: US State Names

December 02, 2016
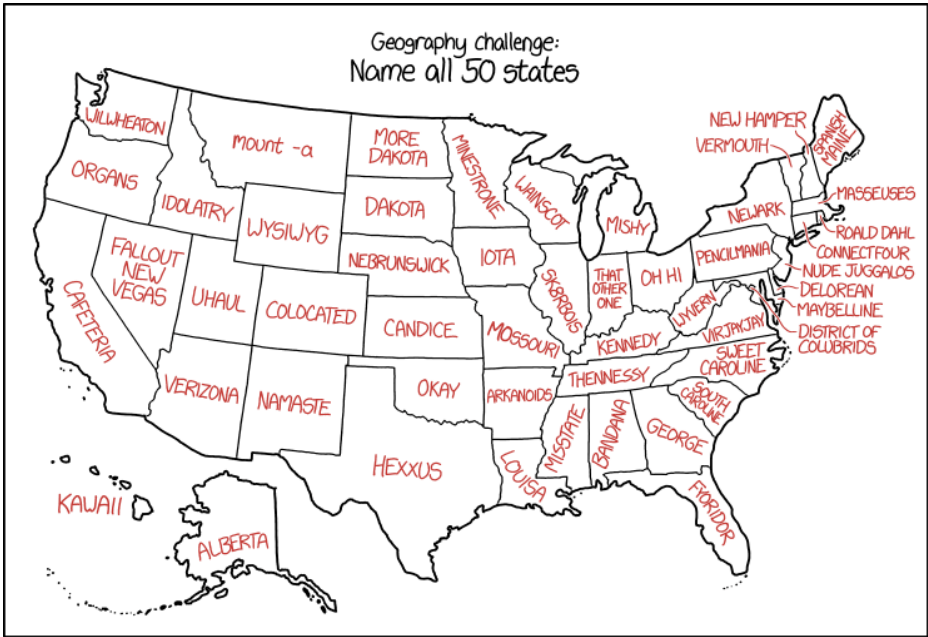
Technically **DC** isn't a state, but no one is too pedantic about it because they don't want to disturb the snakes.

Explanation

Randall has taken a map of the United States of America labeled "Geography Challenge: Name all 50 States" and filled in the states with words that sound similar to the states' names. The joke is that Randall is apparently terrible at remembering states by heart, or else that he interpreted "name" as "give a name to" and is giving each state a name similar to but different from its previous name. A similar joke is also seen in 1554: Spice Girls. Songs such as the 50 Nifty United States make these issues seem rarer, thus making it funnier. Below is the list.

This also may be a play on the ambiguity of the phrase "Name all 50 states". When you are asked to "name" something, it can be a request to supply its given name or to come up with a new name for it. Randall has apparently taken the latter interpretation. He also may be playing with the distinction between an object's identity and its label, e.g., "The state of Texas (identity) is named Hexxus (label)", though you can argue that "Texas" is also a label.

This comic is similar to 1759: British Map. Also note that the text at the top of the comic is not in all caps.

List of States[edit]

Below are the Randall's fictional state names, next to the actual ones in parenthesis, and a short explanation for each one.

LIFE SCORECARD

TIMES WHEN I THOUGHT...

"I'M NOT REALLY HAPPY HERE, BUT MAYBE THIS IS THE BEST I CAN EXPECT AND I'LL REGRET GIVING IT UP."

...IT TURNED OUT I...

SHOULD HAVE STAYED	SHOULD HAVE LEFT SOONER
II	ℍℍ ℍℍ III

Of course, "Number of times I've gotten to make a decision twice to know for sure how it would have turned out" is still at 0.

Explanation

This is a chart showing the outcomes when Randall was confronted with situations he wasn't happy with. It counts 13 situations which he realizes, in retrospect, he should have left sooner than he did, and only 2 situations where he should have stayed. The implication is that, in his experience, it's generally better to leave a situation you don't like, rather than stick with it in the hope that it will improve.

People often stick with situations they are not happy with (a broken relationship, an unfulfilling career, a stale piece of cake) because they think sticking with the situation is better than throwing it away, and fear that they won't find something better if they leave. This is sometimes referred to as "settling", thus the title of the comic. This risk aversion can lead to people sticking with something a lot longer than they ought to if they want to be happiest. Humans' aversion to loss is common; you, being at the necessary reading level for this wiki, can surely easily recall many times when you feared to lose access to something or someone you valued.

Economists and behavioral scientists refer to this behavior as the "sunk cost fallacy", more formally known as Escalation of commitment. Colloquially, this is a situation where resistance to change is justified by the amount of effort or time already expended. A proverb recognizing the error in this thinking is "Throwing good money after bad", while a competing proverb seemingly

justifying the behavior is "In for a penny, in for a pound".
The popular book "Thinking, Fast and Slow" by Daniel
Kahneman details many "errors" in human
decision-making, like our aversions to losses, the sunk
cost fallacy, and others.

The title text references a common thread in human
regret, which is wondering whether we should have
turned the other way when making a choice ("I would
have...", "I could have...", "I should have...", et al).
Randall points out that it is literally impossible to know
how it would have turned out, perhaps urging readers
not to regret their decisions, and to live in the moment. It
also points out that the previous "scorecard" cannot be
regarded as certain, since a person is not given the luxury
of knowing what would have happened if they had made
a different choice. Thus, one can think that they made
the wrong choice and would have been better off if they
had left sooner, but in actuality, it may have turned out
even worse. It is impossible to know, and therefore he
can't be positive that he didn't actually make the right
choice in the situations where he "should have left" .

Although knowing individual outcomes is impossible,
and although it is difficult to separate correlation from
causation when analyzing large numbers of decisions,
rigorous attempts have been made. Notably, a paper
titled "Heads or Tails: The Impact of a Coin Toss on
Major Life Decisions and Subsequent Happiness". The
paper confirmed that "For important decisions (e.g.
quitting a job or ending a relationship), those who make
a change (regardless of the outcome of the coin toss)

report being substantially happier two months and six months later."

#1769: Never Seen Star Wars

December 07, 2016
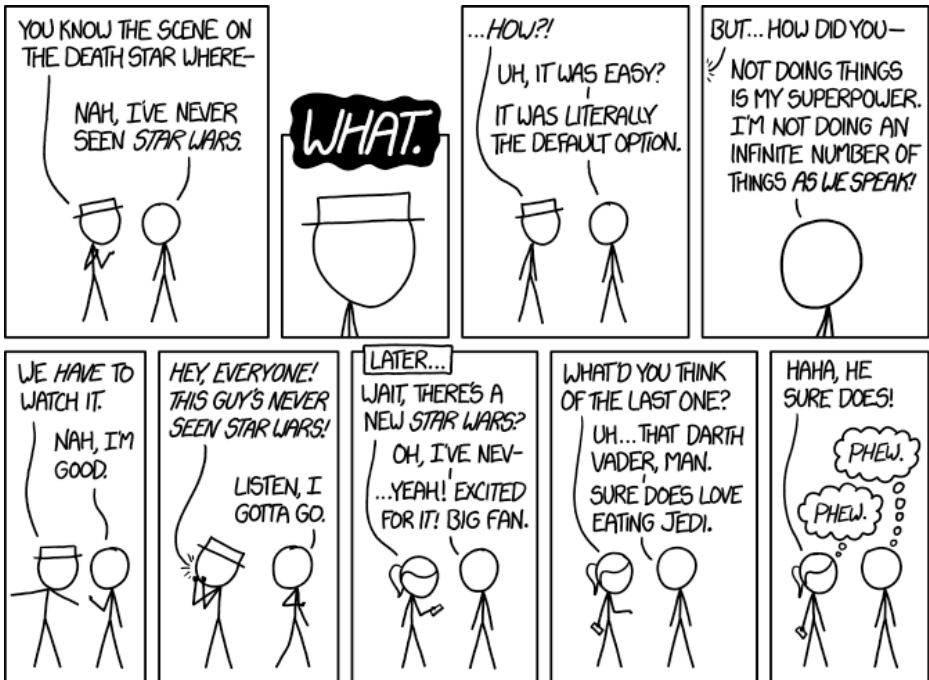
If anyone calls you on any weird detail, just say it's from the Jedi Prince book series, which contains so much random incongruous stuff that even most Expanded Universe/Legends fans collectively agreed to forget about it decades ago.

Explanation

White Hat tries to start a conversation with Cueball about the Star Wars space opera film franchise, which Cueball cuts short by stating that he has never seen the movies. This deeply astonishes White Hat. Because the movies are known worldwide and are ingrained into American pop culture, White Hat considers seeing Star Wars a universal experience.

Cueball reasons that not having watched the films is the "default option", the option that applies if a person makes no explicit choice. In this case it means that if a person does not make the explicit choice to watch the films, then they remain in their initial state of not having watched them. It has been estimated that about 1 billion people, about 15% of the world's population, have seen at least one of the Star Wars movies. This means that about 85% of people alive today have, intentionally or otherwise, exercised that default option. Even accounting for people who have never had the option of seeing Star Wars movies (through poverty, age, country of residence, and so on), people who have not seen Star Wars are still in the majority.

However, the Star Wars mythology is so frequently referenced in American popular culture[citation needed] that it's difficult to consume a normal media diet in the US without being exposed to enough quotes, clips, references, parodies and analogies to piece together most of the plot and major scenes of the films, even having

taken no action to see them. Even without having watched it, it's reasonable that White Hat would expect Cueball to know something about the series. He is right, as it happens, since Cueball is able to recognize that "Death Star" is a Star Wars reference, and later knows that Darth Vader is a major character and that there exists something known as Jedi.

When White Hat finally begins to grasp that Cueball has indeed not seen Star Wars, he declares that they must see it very soon or even immediately. When Cueball again shows a lack of interest, White Hat seemingly calls in social reinforcements to agree with him that having watched Star Wars is the norm. Cueball feels threatened by his friend's unreasonably assertive behavior and quickly removes himself from the situation.

Later, Ponytail likewise wishes to start a conversation about Star Wars, this time about a new movie coming out. Based on his previous experience, Cueball reconsiders admitting to not having seen the past movies, and instead pretends to be looking forward to the new one. Ponytail then tries to continue the conversation, so Cueball bluffs with an incorrect declaration that Darth Vader eats Jedi, likely constructed from other mentions of the Star Wars characters that he has overheard throughout his life. Cueball carefully chooses his words to make it seem as if he knows what he is talking about.

However, Ponytail doesn't call him out on this error, instead agreeing with it. Cueball is relieved — expressed as his thinking an onomatopoeic sigh of relief — as he

believes he has guessed at an accurate piece of information and has avoided entering a similar situation to the previous one. The punchline of this part of the comic is Ponytail's identical feeling of relief, suggesting that she also hasn't seen Star Wars, and is also bluffing to hide that fact. It may be inferred that Ponytail has had similar experiences to Cueball, and now actually starts a conversation about Star Wars in order to avoid that social stigma. It might also be viewed as both of them having lost an opportunity to have a conversation with someone else who hasn't seen Star Wars, because both are afraid of how they'll be treated. Although it's not clear what exactly they're missing out on here.

The "Expanded Universe" (EU) was the term used to refer to canonical content outside of original six motion pictures, including novels, comic books, and video games, which existed in a shared continuity. After the Star Wars franchise was acquired by Disney it was announced that the "Expanded Universe" would be discontinued and rebranded as "Legends", so that the new Star Wars movies would not have to adhere to the established EU canon.

The title text is a tip for people like Cueball, to help them hide deception when roped into conversations about the films. It argues that since the Jedi Prince series of novels established so many strange concepts that don't mesh with most other canon information, it makes for an excellent scapegoat to blame ill-fitting declarations on, seeing as even the most devoted, well informed fan has agreed to forget the entire series. Casually bringing up

such a forgotten series might also make the bluffer out to be extremely knowledgeable about the Star Wars franchise as a whole.

#1770: UI Change

December 09, 2016

I know they said this change is permanent, but surely when they hear how much we're complaining someone will find a way to change things back.

Explanation

The system that sets out the way in which the user interacts with an app or program is called its "user interface" (UI). For an app, that may be the graphic design of the app, and commonly the nature and location of certain controls.

Sometimes, when websites and apps are updated, the UI is modified. This is often done to make space for new features or to make what the developer considers to be an improvement, to the look or efficiency of the app. Occasionally UIs are modified with no obvious goal in mind other than to make changes to give the illusion of improvement when no new features have been added, thus making them completely arbitrary.

Given that some users use some apps many times a day, users tend to learn and get used to the UI of common apps. Whether or not these changes are good in the long term, users often complain because all the workflows they're familiar with have been changed, and often the software never tells you where buttons and other options have been moved to. On occasion, these changes actually make common tasks more difficult and slower to accomplish. For example, in iOS 10, on the quick access control panel (which formerly consisted of a single page of controls), moves the controls for music to a second page (accessed by an additional swipe). While this has a benefit of allowing more information about one's music to be displayed, it adds an additional step to the UI

before one can control their music from the control panel. Changes also often require users to "unlearn" the automatic behavior they have in using the app (such as automatically moving to press a button in its old location).

Old people get to see during their lifetime lots of these kind of changes to the way they did things in the past, and they often don't see the reason why they are made, since the young people who make the changes have a different cultural environment that the elderly won't "get".

Also, just as young people like to complain about petty changes to apps, old people complain about the way their body starts to break down as they age. Muscle weakness makes tasks like opening doors and jars more difficult, the senses such as sight and hearing deteriorate, and mental processes such as memory and rationalization can become slower and less reliable. These have a far bigger impact on one's day-to-day ability to do tasks than a simple UI change.

The comment in the title text could refer to either user interface changes or the effects of aging. As for the former, when websites and programs make unpopular changes, users sometimes start petitions to have them reverted - for example, 1.7 million Facebook users joined "Petition Against the New Facebook". Of course, they didn't get their way, and nowadays few will even remember the old Facebook layout. Cueball's comment in the title text might refer to the fact that people naively

believe that if they complain a lot about an undesired change on the UI of some app that is considered permanent, they might change it back, while in real life those complaints usually don't have any effect, just like the Facebook example given before.

As for the latter, there's no human with the power to undo the effects of aging yet[citation needed], and a petition to God would typically be called a prayer, rather than a petition. Scientific research on how to stop or reverse the effects of old age is ongoing, with limited successes but no indication that we're anywhere close to the ability to "change things back" by restoring an old person to full youthful vigor, nor that this will necessarily happen within the lifetime of anyone currently alive (though neither is it guaranteed not to happen[citation needed], but it will take a while if it does). There has always been a market for immortality, with many historical figures seeking it through alchemy, science, or magic, but as of yet, products claiming to grant it have all been shams. Perhaps Cueball is hoping that advancing technologies will become sufficient to keep him from experiencing the negative effects of old age at all, and that complaining about the situation might improve the pace of progress.

#1771: It Was I

December 12, 2016
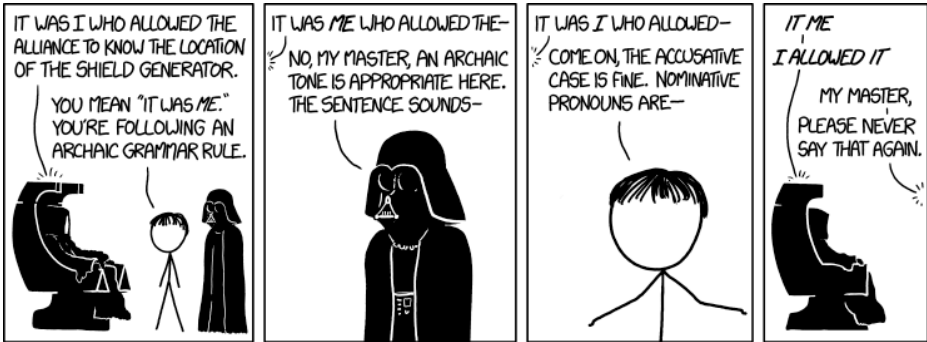
It me, your father.

Explanation

This comic starts with a scene from Return of the Jedi, with Emperor Palpatine, Luke Skywalker (drawn as an xkcd character) and Darth Vader. The original scene in the movie had a tense mood as the hero faces the villains. The comic's version of the scene, however, descends into a silly debate of grammar rules.

Initially Palpatine begins saying "It was I who..." in accordance with traditional prescriptive English grammar. The verb "to be" is a copula, meaning that in a sentence of the form "A is B", both A and B are treated like the subject of the sentence. In most Indo-European languages, subjects use the nominative case (I, he, she, and we) while objects use the accusative case (me, him, her, us). This rule is still strong in languages like German, where speakers still use cases and therefore are familiar with how they work.

The case system in English has almost died out, and only a few fossils of nominative case pronouns still remain. English's case system is so weak that most people have reduced the rule to "I goes before a verb, me comes after a verb or preposition". This gives the correct result in sentences like "It saw me". By extension, speakers therefore often say "It was me" (here's a famous example from Vince McMahon) even though this is not true to the traditional rules. Luke thinks that there's nothing wrong with this modern sense. It's possible the intent was to portray a descriptivist approach to grammar. His

words could also be said to be prescriptivist in a different way, as he is objecting to Palpatine's grammar for not being modern enough.

Darth Vader counters by pointing out that regardless of the grammatical correctness of "It was I", it is a set phrase with a good archaic ring to it suitable for a dramatic revelation from an Emperor. Vader and the Emperor using English archaisms has canon basis in Star Wars, with Vader asking "What is thy bidding, my master?" in The Empire Strikes Back. Historically, "thee", "thou", and "thy" were actually informal pronouns, but because they are not used in modern English, except in reciting historical works like some editions of the Bible, they are thought of as ceremonial and formal today. Using the archaic form would be more consistent with the Emperor's speech pattern.

Palpatine finally decides to take a third option, and uses "it me" , a popular meme on Twitter in 2016. Darth Vader, out of embarrassment, begs him not to talk like that again.

One of Randall's themes is that grammar pedants apply rules to correct other people long after those rules have fallen out of actual usage. Luke is here being an anti-grammar-pedant, asking the Emperor to disapply the rule. See 890: Etymology for another instance of Luke failing to notice semantics.

Characters concentrating on the linguistics of other characters speech while they deliver dramatic revelations,

or the overall situation being already critical, is a classic joke. But characters interrupted for grammatical remarks typically ignore it or just blame the interrupter for not focusing on the important subject. Here, Randall goes one step further by having the other characters join the grammatical argument instead.

The title text runs with the joke in the final panel, applying the same meme to Darth Vader's iconic quote "No, I am your father." It could be said that such a phrasing robs the moment of all gravitas, but then again, Yoda managed to coin a phrase like "Do or do not; there is no try", and still be taken seriously.

#1772: Startup Opportunity

December 14, 2016
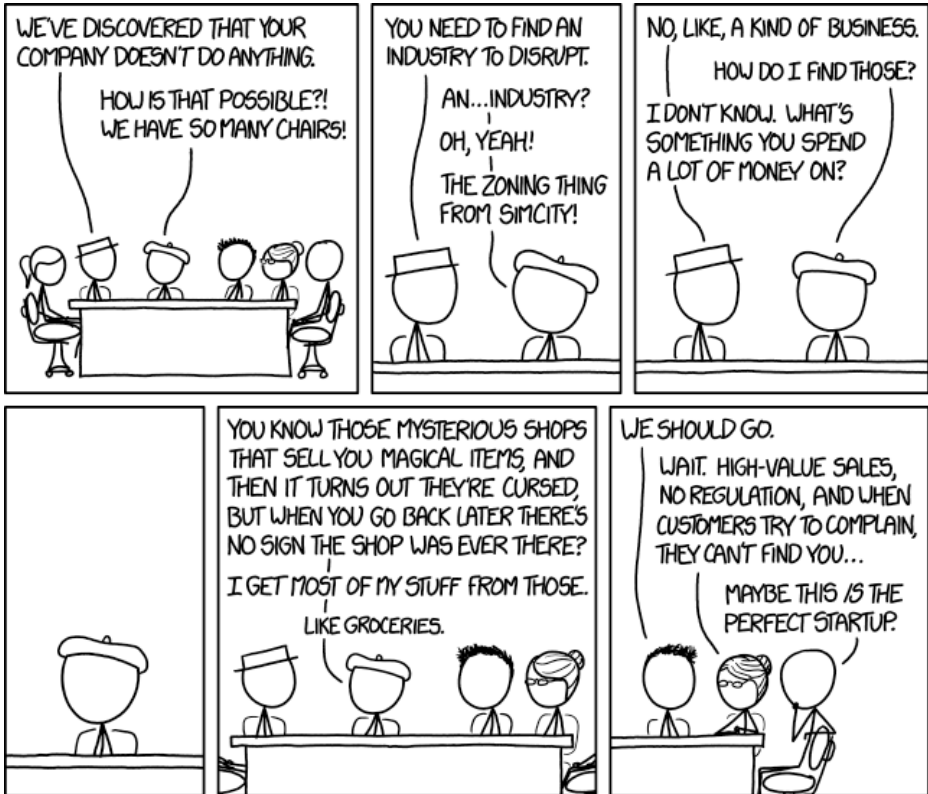
While there's no formal regulation, it turns out their industry group is **NOT** one you want mad at you.

Explanation

Beret Guy's company, first seen in 1032: Networking, 1293: Job Interview and 1493: Meeting, returns, and its purpose is as vague as ever.

Analysts, brought in to advise his company, determine that it doesn't actually serve any purpose (a problem which could ironically be attributed to business analysts in general). Beret Guy is dumbfounded, claiming that his company must do something, and takes a line of reasoning that faintly resembles the sort of logic a child might use. A child that visits an office building might conclude that an office does a lot because there are a lot of employees working inside, unaware that what really makes a successful business is how efficiently it uses its employees to deliver goods and services to the consumer, and whether said goods and services are competitive in their market (by their quality, or through advertising campaigns, or price).

Now, if Beret Guy is given the benefit of the doubt, his odd statement could be taken to mean that his company has many administrators (a.k.a. chairmen); as the owner of a sufficiently large business often interacts with the department in charge of overhead, a person in his position runs the risk of becoming myopic, losing touch with the workers that actually make the business function.

However, this is Beret Guy we're talking about here. He

has demonstrated, time and time and time again, that he is hopelessly out of touch with reality, and this very strip shows no sign of him having gotten a firmer grasp of Earth logic. Displaying less business acumen than a child and less grounding in perspective than a CEO, he uses the number of chairs in the workplace as a yardstick for success, with no mention of his actual, human workforce. It may even be a stretch to say that a child would make the same assumption based on the number of chairs.

The analysts suggest that Beret Guy find an industry to disrupt. The mention of "industry" immediately reminds Beret Guy of SimCity, where Industrial (along with Residential and Commercial) is one of the three main zone types - it allows factories and farms to develop. Disruption means coming up with a product that redefines what the market expects and leaving existing competitors in the dust (for instance, smartphones disrupted mobile, digital photography disrupted film, and air travel disrupted rail and sea travel (and is in turn being disrupted by high-speed rail)) - it's now an industry buzzword and virtually every company claims to be "disruptive".

When pointed in the right direction, Beret Guy realizes that the main industry he deals with is weird disappearing shops selling cursed goods, such as the WiFi in 1812: Onboarding. This shop has been mentioned multiple times. This is a common trope in fantasy stories (notably Stephen King's novel Needful Things, using this exact premise, and Discworld, which is also

mentioned in other comics), and as soon as Hairy hears about it he wants out of the building, but as his colleagues point out it also bears more than a passing resemblance to many dodgy startup companies. These appear suddenly with a lot of promotion and a marketable idea, looking for venture capital (or, a lot of times in recent times, pre-orders on Kickstarter). However, many startups fail - either because they didn't take into account the difficulties involved in bringing a product to market, or because they were an active scam - and disappear without a trace, leaving customers either empty handed or with a buggy product that falls short of promises. As Cueball notes, these cursed shops are actually the perfect startup, at least from a moneymaking perspective. This humorously ignores the more obvious larger problem, that such a business would be impossible to create due to not actually having magical items to sell (unless, of course, one is referring to items that are sold by making unrealistic or implausible claims as to their use, which could be considered similar to "magic". This is common enough in the real world, and many such products call themselves "magic" without actually explicitly claiming to use mysterious powers of sorcery. One character could be thinking literally, and the other one figuratively). Apparently, the business may become one, if he does spend most of his money there.

As with most Beret Guy comics, there are multiple layers of absurdity. For a start, the fact that he - and by extension, the rest of the cast - live in a world including supernatural shops is, while not inconsistent, still

supernatural. The assertion that this is where he buys most of his materials and other products is also curious, given the shops' inherent temporary nature, as it implies either something about him causes these shops to appear, or that he is drawn to these shops instinctively. Most absurdly, he apparently purchases his food from these establishments (which may also serve as an explanation for his 'soup outlet' in 1293: Job Interview), despite previously stating everything they sell is cursed, conjures troubling images in the mind of how exactly food would be cursed-and its effects. Perhaps this explains Beret Guy's strange powers.

The title text alludes to the fact that irrespective of whether or not there is formal regulation, it is unwise to anger a group of people who have access to cursed magical items. It is easy to imagine numerous ways they could make one's life substantially worse.

In 2332: Cursed Chair, Beret Guy purchases a chair from such a shop. In 2376: Curbside it is revealed that while the shops seem to require masks, they do not have curbside pickup.

#1773: Negativity

December 16, 2016
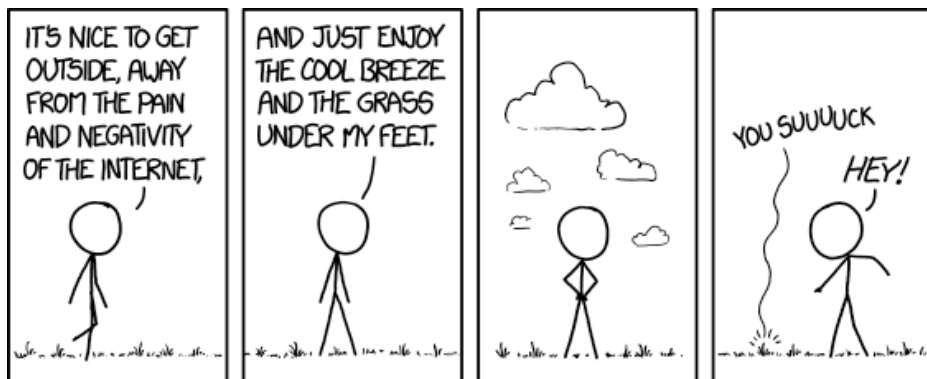
[Google search] how do I block my lawn

Explanation

Cueball is going outside for some fresh air because he wants to escape the trolls of the Internet, which is known for hosting many hostile and unpleasant ideas and people. However, as he walks, some grass speaks up to insult him, and Cueball is upset to find that he hasn't escaped the negativity at all. (see 1749: Mushrooms which involves an unusual occurrence of a vocalizing angry mushroom).

The title text expands on this, with him searching Google for how to "block the lawn". Blocking someone refers to a standard setting on websites and online services that can prevent certain users from communicating with you, but it is as yet unknown how this would work for a lawn insulting you. This is made ironic by the fact he is using the Internet to find an Internet technique (blocking) on a non-Internet object, while at the start of the comic, he just wanted to escape the Internet.

The term "blocking" is actually used in lawn-care to refer to techniques where sunlight is restricted from reaching the lower parts of the grass stems and to persuade the root system to grow deeper into the soil.

Later in 1802: Phone, Cueball cannot go outside for a walk without bringing his phone as he cannot stand to be disconnected from his feed, which is the exact opposite of what he tries in this comic. Although in the title text he does try to disconnect, he then finds that this is also

bad because it leads to social isolation.

#1774: Adjective Foods

December 19, 2016
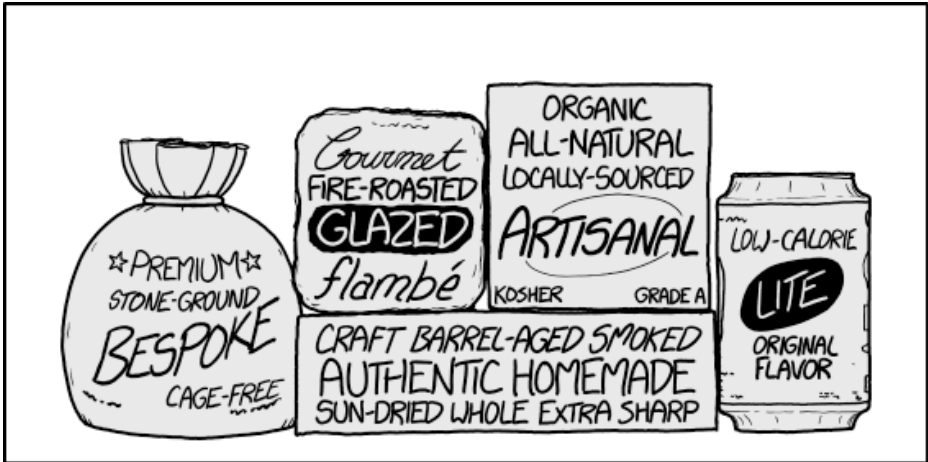
I'M TRYING TO TRICK SUPERMARKETS INTO CARRYING MY NEW LINE OF ADJECTIVE-ONLY FOODS.

Contains 100% of your recommended daily allowance!

Explanation

In this comic, Randall imagines creating food items whose labels contain only adjectives, and putting them on display in supermarkets. This is likely a jab at food market buzzwords, which usually rely on adjectives that bring up certain feelings based on how the food is "supposed to be", rather than a factual description of what the food actually is. By removing all nouns from product labels, Randall takes this trend to its extreme. The items depicted in this comic are filled with popular descriptions that make them sound appealing, but give no useful information about their contents. It is implied that some consumers who are susceptible to buzzword marketing will nevertheless purchase these products.

The adjectives seen in the comic are:

- Premium: A generic term that indicates high quality, which can be used to describe any food. There is no objective standard for what can be labeled "premium".
- Stone-ground: A term typically used to describe milled grain products such as flour, corn meal, or mustard. This term evokes a sense of tradition (as opposed to industrial processing), and by association, heartiness or healthiness. In reality, contents are rarely distinguishable no matter what grinding surface was used.
- Bespoke: A word meaning "custom made to individual order", in contrast to factory mass-produced items

typically found in supermarkets. It is supposed to imply higher quality due to the producer giving it more attention. However, mass-produced items are usually ones that pass more strict quality controls, have more consistent results, and appeal more to popular tastes.

- Cage-free: A term typically used to describe chicken. Chickens are usually farmed in tight cages and not allowed to move freely. Ethical concerns for the chickens' welfare led to preference for better handling methods such as "cage-free" and "free range". These terms however are still often abused by farmers looking to maximize their profits, as "cage-free" can simply mean crowded in a filthy barn, and "free range" might be a tiny patch of grass which chickens are allowed to, but rarely actually, visit.

- Gourmet: Another generic term that indicates sophisticated, fancy, or exotic properties. Any food can be labeled "gourmet" without any objective standard.

- Fire-roasted: A method of preparation by heating food over an open flame (as opposed to an electric oven or microwave). This process typically gives the food a distinct flavor through caramelization and by absorbing the smoky flavor from the fire itself.

- Glazed: A description indicating that the food has been coated with a thin layer of glossy liquid. This is usually done to improve the flavor and texture.

- Flambé: A method of preparation by adding alcohol to the food and setting it on fire. This is mainly

done for dramatic presentation in a restaurant setting. The alcohol content, and the flames to a lesser extent, can give food additional flavors. Note that food that is packaged cannot be flambé (burning),[citation needed] although in principle the customer could set it on fire.

- Organic: In the context of food, this term describes methods of production which meet certain standards for sustainability and lack of synthetic chemicals. These standards vary by country and region. While one can support organic farming for ecological reasons, many also incorrectly associate "organic" to mean better tasting, more nutritious, or otherwise healthier. Experiments to date have found no difference in safety, nutrition, and taste between organically and conventionally produced foods.

- All-natural: A term that generally implies that all the food's ingredients were directly sourced from domestication and farming, with no additives or alterations through modern technologies like chemical synthesis or genetic engineering. Similar to "organic", definition and enforcement of this term varies by country and region. While it is true that food processing technologies have led to an explosion of junk food, it is not true that "natural" is necessarily always better. Many natural products can be harmful if used carelessly, and some processing methods do in fact improve the safety and nutrition of food.

- Locally-sourced: A term indicating that the ingredients are procured and prepared in the same general geographical area where it is sold, instead of arriving by

long-distance shipping or international trade. People may prefer to "buy local" due to perceived benefits to the local economy, community, and environment.

- Artisanal: Similar to "bespoke", this is a word meaning "created by hand by a skilled craft worker". Again this is in contrast to mass-produced items in factories where most preparation is done by machines and where workers have little knowledge of the methods.

- Kosher: A term which designates foods that may be consumed in accordance to Jewish religious dietary laws. This is important to people who follow Jewish practices, but otherwise has little significance to non-Jewish people.

- Grade A: In some countries and for some specific items (such as eggs in the US), the grade can carry specific meaning about the item's quality and suitability for sale and consumption. However without context for what the food is, this is nothing but another meaningless term which alludes to high quality but carries no weight.

- Craft: A term similar to "artisanal".

- Barrel-aged: A term typically used to describe fermented products such as alcoholic beverages, vinegar, and certain sauces. Sealing these items in wooden barrels and allowing them to age helps them to develop more complex flavors. The barrels themselves can also impart flavors to the food.

- Smoked: A method of preparation by placing food, often meats or cheeses, in chambers filled with

dense smoke.   The food slowly absorbs the smoke which enhances its flavor.

- Authentic: Typically used for foods imported from another culture, this term indicates that the ingredients, preparation, taste, etc. are true to the original, native version.   It can also indicate that the ingredients are real, not substituted with similar but lower-quality alternatives. However, since there's no objective criteria for what can be called "authentic", the word has largely lost its meaning and the quality of items labeled as such still varies greatly.

- Homemade: Another term which evokes the idea of careful preparation by hand rather than commercial mass production. People will often prefer meals prepared from scratch at home by themselves or close family members, likely because they grew up eating similar meals and have developed a fondness for its particular characteristics.   However, there is no reason to believe one will enjoy food prepared in someone else's home any more than commercially produced versions.

- Sun-dried: A term often applied to fruits and vegetables that have been dehydrated using heat from the sun, e.g. sun-dried tomatoes.   As with "stone-ground", it's questionable whether the heat source in this case makes any difference to the food.   Sunlight does not conceivably add any flavor to the food, so presumably any radiant heat with similar intensity will produce the same results.

- Whole: A term applied to food that has not been

broken apart into smaller pieces, e.g. whole walnuts, or food that has not been processed to remove nutritious parts, e.g. whole grains.

- Extra sharp: Often applied to cheeses, indicating a stronger or "sharper" flavor, e.g. extra sharp cheddar cheese.

- Low-calorie: Used to label foods that have been formulated to deliver fewer calories than a regular food. Although low-calorie foods may be helpful for dieters to control their caloric intake, they are not necessarily healthier. For example, the low-calorie formulation might have replaced fat (which has high calorie content) with added sugar (with comparatively lower calorie content per gram) and salt (to enhance flavor lost from the removal of fat). Neither excessive sugar nor salt is healthy.

- Lite: Similar to 'low-calorie', 'lite' is applied to foods that have fewer calories or lesser fat content than regular food. It can also apply to other contents, e.g. alcohol ("lite beer").

- Original flavor: If a company produces many products, it will sometimes differentiate them by flavor. After many years, the first flavor that a product came in can often be preferred by customers. Companies will often capitalize on this by marketing a product as having the "original flavor", rather than one of the variants.

- Recommended daily allowance (title text): Information often found in the nutritional information on food labels which compare the amount of macronutrients,

vitamins and minerals to a prescribed standard amount an average person is deemed to require in their daily diet.

The title text may be a continuation of the main joke, in that Randall has removed the noun (nutrient type) which the recommended daily allowance is supposed to measure. This leaves "100%" which gives an impression of good value, but it is useless without knowing what it describes. Alternatively, it may be suggesting facetiously that the foods contain 100% of the recommended daily allowance of adjectives, given the high quantity of them in the product names. Obviously, adjectives are not a nutrient the human body needs that would normally be subject of a nutritional chart.[citation needed]

This joke is very similar to 1060: Crowdsourcing, in that Randall is doing nothing, and trying to make it look like he is doing something. It expresses the opposite idea from comic 993, Brand Identity.

#1775: Things You Learn

December 21, 2016

HOW EASY IT IS TO GROW UP WITHOUT LEARNING [THING]

EASY

- 100 DIGITS OF PI
- LYRICS TO *WE DIDN'T START THE FIRE*

HOW BAD IT IS IF YOU DON'T KNOW [THING]

NOT BAD

THAT CAT BITES ARE REALLY SERIOUS AND IF BITTEN YOU NEED TO WASH THE BITE AND CALL A DOCTOR IMMEDIATELY

THE RED FLAGS FOR AN ABUSIVE RELATIONSHIP

THE SIGNS OF A STROKE

COUGH INTO YOUR ELBOW, NOT YOUR HAND

VERY BAD

HOW TO RIDE A BIKE

THAT YOU HAVE TO EMPTY THE DRYER LINT TRAP

- HOW TO ESCAPE MOVIE QUICKSAND
- LYRICS TO *12 DAYS OF CHRISTMAS*

STOP, DROP, AND ROLL

- TV THEME SONGS

THAT YOU HAVE TO PAY TAXES

HARD

Guess who has two thumbs and spent the night in an ER after trying to rescue a kitten that ran under his car at a stoplight and climbed up into the engine compartment? And, thanks to antibiotics, will continue having two thumbs? THIS GUY. (P.S. kitten is safe!)
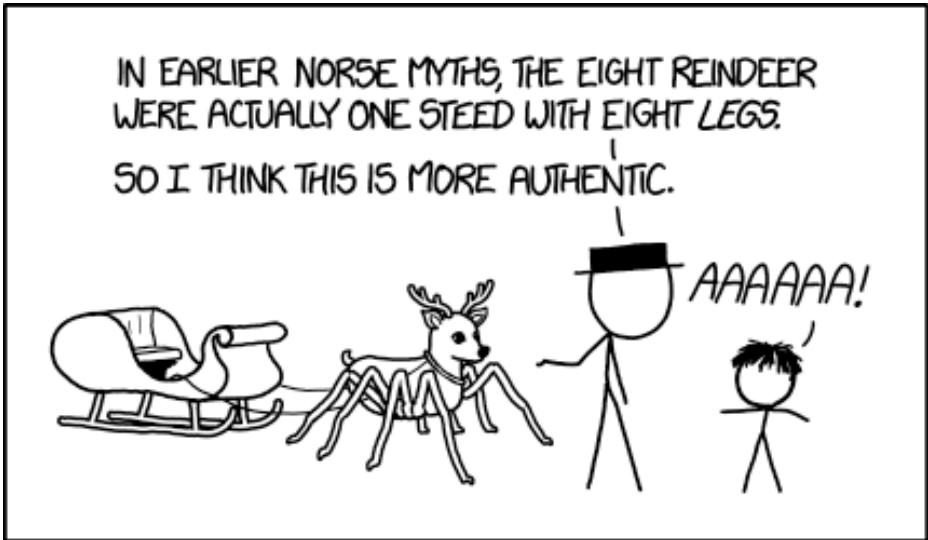
Explanation

This graph shows various items of information plotted by two criteria: a horizontal "How Bad Is It If You Don't Know [THING]" axis and a vertical "How Easy It Is To Grow Up Without Learning [THING]" axis. Specifically, the vertical axis measures roughly how likely the average person is to remain ignorant of a particular item. The horizontal axis measures the likelihood and severity of bad consequences arising from such ignorance.

The title text describes an encounter Randall had where a cat climbed into the engine compartment of his car. It probably serves as an explanation for the seemingly out of place point on the graph about how serious cat bites are. The "two thumbs" is a reference to a well known type of jokes among English speakers. One of the most frequent forms is one person interrupting another mid-speech and asking "what has two thumbs and doesn't give a f*ck? THIS GUY!", before pointing to themselves with their thumbs. The idea is that you only direct the attention to your thumbs so that they can point back to you, though mentioning the thumbs was not actually required except as a topic change. Randall plays on an inversion of this joke as he (presumably) was bitten on the thumb might have lost a thumb or perhaps not have been able to make it at all without the intervention of the ER people. So here the "who has two thumbs", is not a deceiving distraction out of a boring conversation, and the thumbs are actually the focus of

the phrase.

#1776: Reindeer

December 23, 2016

And then in a twinkling, a sound gave me pause / From the roof came the scratching of eight tarsal claws.

Explanation

In the Christmas comic of 2016, Black Hat is at it again, freaking out a young Hairy, by replacing the eight reindeer of Santa's sleigh with a single spider-legged reindeer, thus with eight legs. He considers this "more authentic" because Santa Claus is based on Odin (among many other things), the chief god of Norse mythology. On the pagan holiday of Yule, Odin was said to ride his eight-legged horse, Sleipnir, across the land. Children would leave one of their boots out and fill it with hay for Sleipnir to eat, then Odin would refill the boot with gifts. This predates the Christmas tradition of hanging stockings by the chimney.

The traditional interpretation of the horse with eight legs is a normal equine body, with a pair of identical legs where each leg of a normal horse is. As such, Sleipnir looks majestic and not entirely unnatural. Black Hat's interpretation is to use the body plan of a spider. The result of this is to make a chimaera that is both creepy and terrifying, at least to those with arachnophobia (the quite common fear of spiders).

The title text is a parody of two lines from the poem "Twas the Night Before Christmas", "And then in a twinkling, I heard on the roof / The prancing and pawing of each little hoof."

The lines are changed to what they could have been if Santa had a spider-legged reindeer - the sound of "eight

tarsal claws", referring to the small pair (or triplet) of claws at the end of each of a spider's eight legs. These claws allow them to hold onto objects, including their own web. However, as such an eight-legged spider would have 16 or 24 claws, the text is slightly incorrect.

#1777: Dear Diary

December 26, 2016
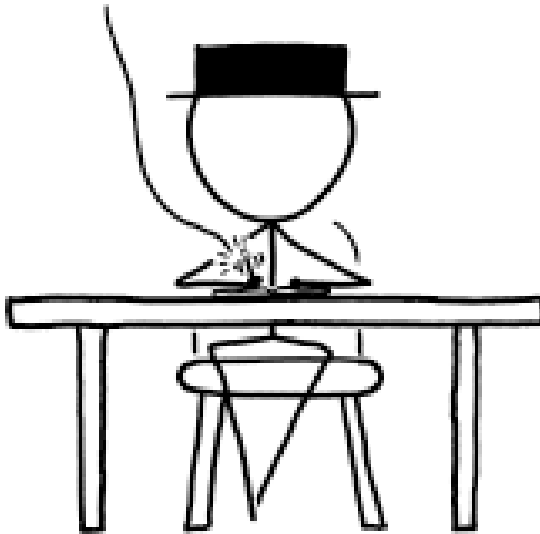
Dear Diary: UNSUBSCRIBE

Explanation

Black Hat is writing in a diary (probably his, but possibly not; see below). His entry starts with the common idiom "Dear diary". In a regular diary entry, this opening is used to give the impression of writing to a trusted friend, the diary being anthropomorphized to take that friend's role. However, where other people would write about their day or put their feelings into words, Black Hat's diary entry consists of a standard phishing scam attempting to request some private information in exchange for a large cash amount which does not exist. In this case, the scam is the infamous Nigerian Royalty scam, where the 'royalty' needs bank details to give money, when it will in fact be taken. Black Hat apparently is so used to tricking people that even his own anthropomorphized diary is not safe from his pranks. Alternatively, the entry is intended for anyone who looks at his diary without his permission. It's also possible he has obtained someone else's diary and is somehow trying to scam the diary's owner, although it's not clear how that might work. Or, since it is a rather obvious scam, he may simply be trying to scare the diary's owner, perhaps the same child as he traumatized in the previous comic with a reindeer mutated to look like a spider.

This comic creates a stark contrast by putting together elements that seem similar, but do not belong together, for comedic effect.

• Combining old-school hand written media (a diary)

and memes from the electronic age (a phishing attempt as usually found in spam mail).

- Contrasting the very personal, intimate atmosphere of "Dear diary" with something that is normally automatically replicated to millions of mail addresses.

- Opening up with a sentence that might come from a real personal diary (many people will fantasize about being rich or famous in their diaries), and following up with something that nobody would expect from a personal diary.

It is possible that the diary is actually the journal from the Journal series, and that ever since being outdone by Danish, he no longer uses it for recording all the things he would say if he were nice.

The title text is similar to 1675: Message in a Bottle, which also uses the word "unsubscribe" in an unusual way. The title text also mimics a standard way to get off some mailing lists, so perhaps it's Randall's diary that Black Hat is molesting, and therefore the title-text is Randall expressing a desire to be disassociated from it.

#1778: Interest Timescales

December 28, 2016
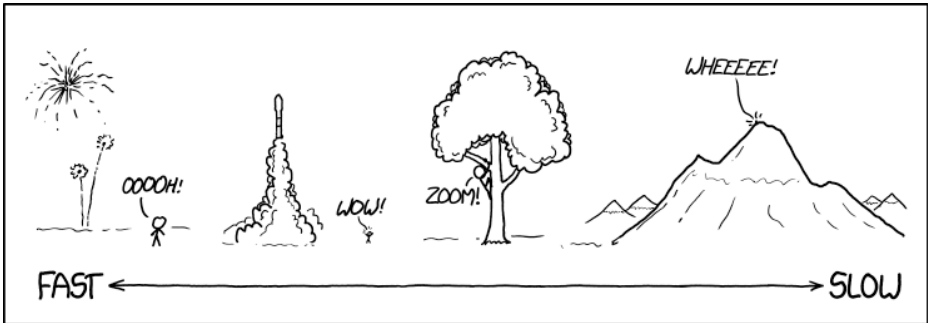
MOST OF MY INTERESTS FALL UNDER "THINGS RISING UP FROM THE GROUND, HANGING IN THE AIR, AND THEN DRIFTING AWAY ON THE BREEZE," JUST ON VERY DIFFERENT TIMESCALES.

Sometimes, parts of a slowly-rising mountain suddenly rise REALLY fast, which is extra interesting.

Explanation

Randall's sharing a bit about himself and the things that interest him, in one of his strange but still funny graphs.

The caption reads: "Most of my interests fall under 'things rising up from the ground, hanging in the air, and then drifting away on the breeze,' just on very different timescales." The four examples fit this as follows:

In the case of a fireworks display, the fireworks fire up into the air, explode, and then the glowing embers drift away on the breeze in the course of a few seconds. This comic was the last released before this years New Year comic 1779: 2017, so this may explain the thoughts of fireworks.

In the case of a rocket launch, the rocket launches from the ground into space, leaving a large plume of smoke that slowly dissipates over many minutes. The rocket remains in space for a time, and then later it re-enters the atmosphere and reaches the ground—in the case of a typical parachute-descent system, it literally drifts through the air. A typical timespan for such an event is several days or weeks.

In the case of a tree, it grows from the ground upwards, remains there until autumn comes, then drops its leaves, which drift on the breeze. This process takes months.

Entire trees like the one shown typically last several decades or even centuries before they die - if not felled by

humans, most are eventually toppled by the wind as well. The breeze needed for that can be measured on the Beaufort scale, likely above 5.

Finally, in the case of a mountain, a mountain rises slowly from the ground due to movement of tectonic plates which result in mountains either via volcanic activity or by simply pressing the ground up through the process of subduction (see 1388: Subduction License). The mountains are then very slowly broken down by natural erosion forces, and the stone particles disperse on the wind. These events are much slower than the others, typically taking tens of millions of years to completely erode away a mountain.

Additionally, some humor stems from the fact that Cueball acts like the mountain is a roller coaster, even though a mountain may take thousands or millions of years to noticeably change.

The title text refers to the dramatic event in which a mountain suddenly explodes due to a violent volcanic eruption. Such events are rare and potentially deadly to living things. Calling it "extra interesting" is an understatement.
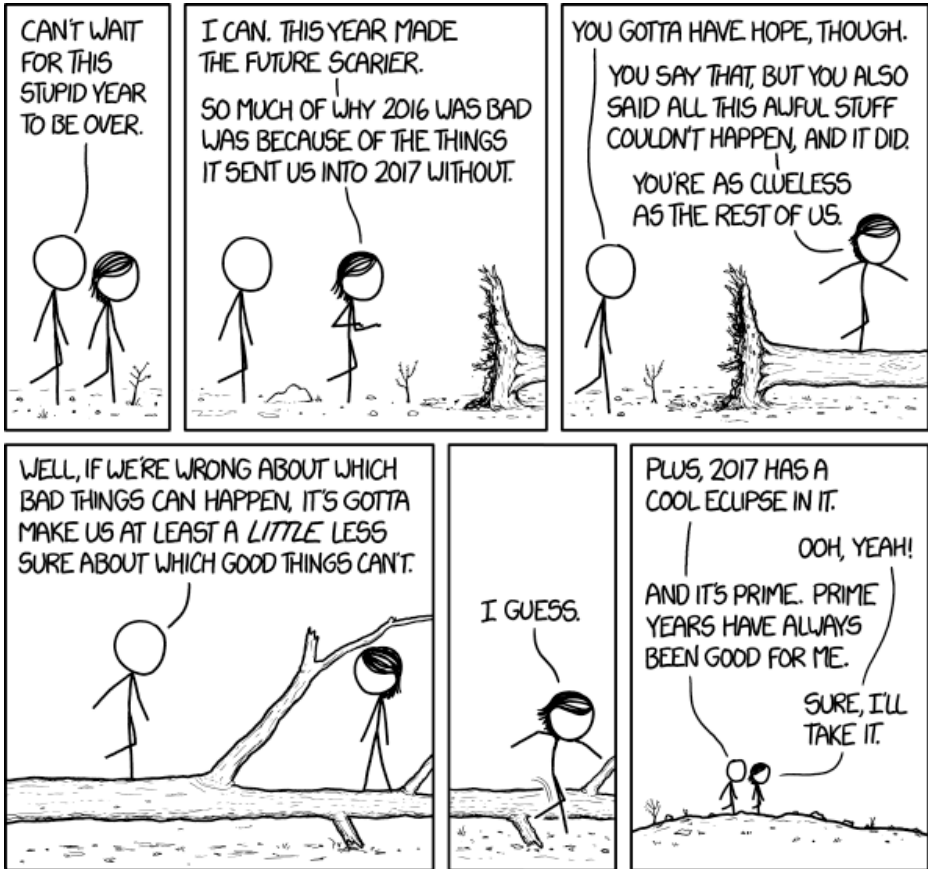
Things are looking good for the eclipse--Nate Silver says
Earth will almost definitely still have a moon in August.

Explanation

In this New Year comic, Cueball and Megan share some of their (or Randall's) thoughts about the ending 2016 and the new year 2017 (hence the title). 2016 was a year which many people eagerly awaited the end of because of its increased turmoil (terrorist attacks, controversial political events in numerous countries including the election of Donald Trump for president in the United States and the United Kingdom voting for Brexit) as well as the deaths of an unusually large number of well-known and beloved celebrities (several of these died in the first few days after Christmas).

Instead of simply condemning 2016 as a terrible year and expecting 2017 to be significantly better, Megan observes that much of what made 2016 bad is the effect that it will have upon future years rather than the actual events themselves (for instance, a divisive U.S. presidential election has caused significant controversy in 2016, but President Donald Trump actually took office and began to affect the world as President in 2017). Megan specifically states that 2016 was bad was because of the things it sent us into 2017 without. As it is known that Randall is a Hillary Clinton supporter (as shown in the 1756: I'm With Her comic), an additional reading of that line could be that we are headed into 2017 "without" a Hillary Clinton presidency. It can also refer to the many dead celebrities passing in 2016, (at least three famous musicians/actors so recent that they died after Christmas Eve), as we would be without all of them in 2017.

Cueball claims that they should still have hope for the future, but Megan states that people had claimed that many of the bad things that did happen in 2016, could not happen (for instance Trump and Brexit). And as these things did happen, she foresees even worse events occurring in 2017, that we did not even think would be possible.

However, Randall also offers a glimpse of hope in the last few panels when Cueball observes that, just as all of the bad things in 2016 were unexpected, good things in 2017 that are unexpected could also happen, which should make us less sure what good may come of 2017. As such, he argues that we should hold on to our hope even though things seem difficult right now.

As the conversation unfolds, Megan and Cueball encounter an uprooted tree and cross it like a balance beam. This is a visual metaphor; the dead tree represents the end of the old year, while the crossing represents the transition into the new year. This is similar to the magical toboggan from Calvin and Hobbes that serves as a metaphor for their conversations, mentioned in 529: Sledding Discussion and 409: Electric Skateboard (Double Comic). Or Randall just included this because he thinks using trees as balance beams is fun.

In the last panel Cueball mentioned that 2017 will also have a cool eclipse, going through the central parts of North America. This may also serve as a reminder that the Earth continues to spin on despite all of the human turmoil going on on its surface. This is literally true, as

the eclipse Randall is excited about is caused by the orbits of three celestial bodies lining up just right (the Sun, the Earth, and the Moon).

Cueball then also notes that 2017 is a prime number and states that prime-numbered years (prime years) have always been good to him. He thus illustrates the positive attitude that people can choose to take in order to see all that which is good and to spread a little bit more cheerfulness, and Megan is ready to take this positive view, although she may not totally buy in to it. This could also be a pun referencing the saying "being in his prime years".

It should be noted that Cueball is working with a relatively small sample size. If Cueball is roughly the same age as Randall Munroe, prime-numbered years he was alive in would include 1987, 1993, 1997, 1999, 2003, and 2011. Prime years are always uneven, and therefore never feature US presidential elections, or the Olympic Games (although if the COVID pandemic had occured four years prior, the "2016 Olympics" might have also actually occured in a prime-numbered year, just as the 2020 Tokyo games were delayed and held in the year 2021, itself only the semiprime of 43x47).

The title text is a reference to Nate Silver who is well-known (in the United States) as an election polling analyst on FiveThirtyEight. His model allowed for a higher chance that Donald Trump would win the presidency compared to other similar models — though the fact that he still favored a Clinton win may be

contributing to getting humor from the idea that he may be "wrong" again, and the Moon could possibly vanish in 2017, making the year definitely worse than 2016. (Earth and Moon are so close in the space order of things, that any event affecting Moon orbit seriously will almost certainly end our civilization too.) This is accentuated by the qualifier "almost definitely", which is of humorously low confidence for presenting a fact as certain as the Moon not somehow disappearing within the next year.

In the background of the first few panels of this comic, we see a fallen tree, but a sapling growing in its place. This may be a subtle message by Randall that there is still hope, and that things will be alright in the end.

Randall previously mentioned his excitement for the 2017 eclipse exactly three years earlier in 1302: Year in Review, where Megan complains about not having seen an aurora during 2013, and she really hopes they don't cancel the 2017 eclipse. So this comic is the second time Randall has expressed concern that he will miss the eclipse. Leading up to and after the eclipse Randall released six more comics on the subject: 1868: Eclipse Flights, 1876: Eclipse Searches, 1877: Eclipse Science, 1878: Earth Orbital Diagram, 1879: Eclipse Birds, and 1880: Eclipse Review.

There have been three previous New Year's comics with only the year used as the title: 998: 2012 in 2012, 1311: 2014 in 2014 and 1624: 2016 in 2016. This is the first odd-numbered year (and thus of course the first prime year) using only the new year as the title.

Things in 2016 that could be described as bad[edit]

Obviously, anything in this list is controversial so the section title is hedged. Also, this was written in 2024, so everything seems not so bad compared to 2020, when the COVID-19 pandemic hit.

- The World Health Organization announced an outbreak of the Zika virus.
- An earthquake of magnitude 6.6 struck southern Taiwan, killing 117 people.
- North Korea launched a reconnaissance satellite that was condemned internationally as a long-range ballistic missile test.
- Suicide bombing attacks at Brussels' Zaventem airport and Maalbeek metro station kill 35 people and injure 300 more.
- A 7.8 earthquake struck northwestern Ecuador killing 676 people and injuring over 6,000.
- EgyptAir Flight 804 crashes into the Mediterranean Sea en route from Paris to Cairo, killing all 66 people on board.
- Gorilla Harambe was shot and killed at the Cincinnati Zoo and Botanical Garden in an incident involving a child leading to a global meme.
- A gunman claiming allegiance to the Islamic State opened fire at a gay nightclub in Orlando, Florida, killing 49 people and injuring 53 others.
- The United Kingdom voted in a referendum to leave the European Union.
- 86 people were killed and more than 400 others injured in a truck attack in Nice, France, during Bastille Day celebrations.
- In Turkey, an unsuccessful coup against resulted in the deaths

of at least 240 people.

- A 6.2 earthquake hit central Italy, killing 299 people.

- The government of North Korea conducted its fifth and reportedly biggest nuclear test.

- Global CO2 levels exceeded 400 ppm at the time of year normally associated with minimum levels.

- U.S. intelligence agencies publicly accused the Russian government of using computer hacking to interfere with the U.S. election process.

- The Washington Post released a videotape showing candidate Donald Trump privately bragging about sexual improprieties.

- WikiLeaks released thousands of private emails from inside the political campaign of candidate Hillary Clinton.

- Donald Trump was elected the 45th President of the United States. (Let's not start on this; at least some people consider it bad)

- LaMia Flight 2933 crashed into a mountain, killing 71 of the 77 people on board.

- A Tupolev Tu-154 jetliner crashed into the Black Sea shortly after taking off. All 92 people on board were killed.

- The term ghost kitchen is coined to describe deceptive alternate names for restaurants on food delivery apps to garner more orders.

Things in 2017 that could be described as good[edit]

A disclaimer that not everyone will consider all of these things as positive.

- Millions of people worldwide join the Women's March

becoming the largest single-day protest in American history.

- An annular solar eclipse was visible from Pacific, Chile, Argentina, Atlantic, Africa.
- Nintendo released the Switch worldwide.
- The Eurovision Song Contest took place in Kyiv, Ukraine.
- Montenegro joined NATO as the 29th member.
- The 2017 World Expo opened in Astana, Kazakhstan.
- The Treaty on the Prohibition of Nuclear Weapons was voted for by 122 states.
- The first observation of a collision of two neutron stars occurred with both gravitational and electromagnetic waves from the event detected.
- The Great American Eclipse was visible within across the entire contiguous United States of America.
- The International Olympic Committee awarded Paris and Los Angeles the right to host the 2024 and 2028 Summer Olympics, respectively.
- Cassini–Huygens ended its 13-year mission by plunging into Saturn, becoming the first spacecraft to enter the planet's atmosphere.
- A new species of orangutan was identified, becoming the third known species of orangutan and the first great ape discovered in almost a century.
- A paper was published recognizing a high-velocity asteroid as originating from outside the Solar System, the first known interstellar object.
- The Walt Disney Company announced that it would acquire

most of 21st Century Fox.

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